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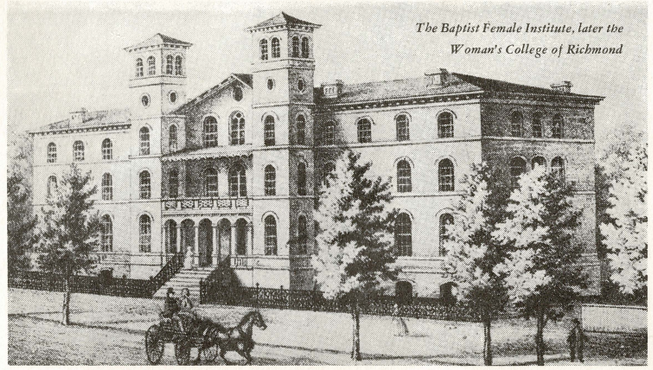

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THE PRODUCTION OF LINEN IN PHARAONIC EGYPT

Gillian Vogelsang-Eastwood

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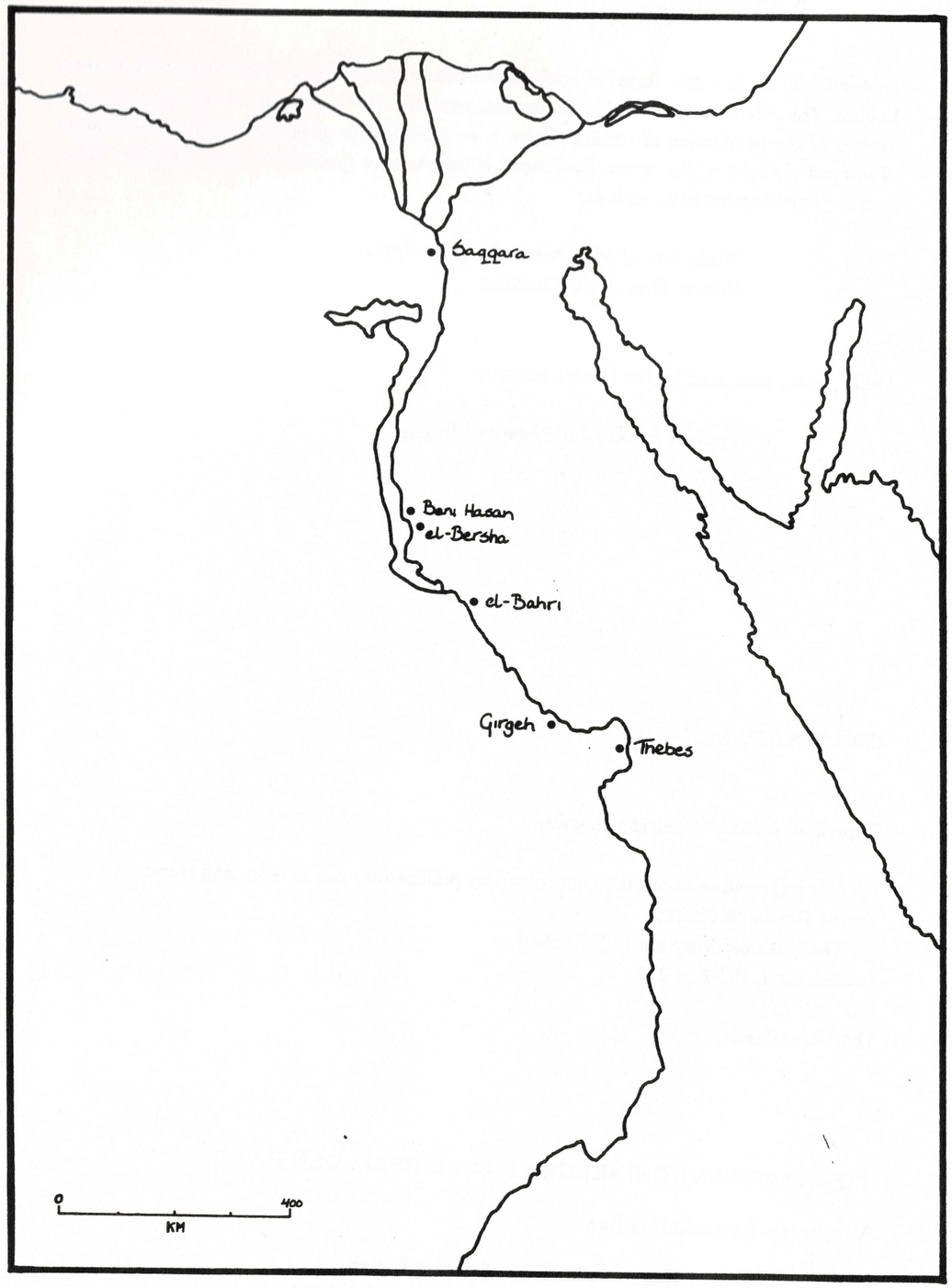

Map of Egypt showing the position of the sites and tombs mentioned in the text

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INTRODUCTION

Egypt was famous throughout the ancient Near East both for the weaving of linen cloth and for the quantities produced. Cloth was sent as costly gifts from one king to another and given to a labourer as 'wages' in return for his work.[1] Cloth was regarded as an essential element in everyday life as it could be used for everything from clothing, bedding, to the trappings for animals or the sails of a ship. It was in fact one of the most widely used item throughout ancient Egypt.

Although other textile fibres were used in Pharaonic Egypt, namely, sheep's wool, goat hair and a form of coir, the majority of the textiles were made from the plant *Linum usitatissimum*, flax. Cloth made from this fibre is described as linen. Turning the flax plant into a piece of cloth is an elaborate process, which must have taken a long time to develop. Yet it can be shown from excavated textiles from the Fayum region that by the Neolithic period (*ca.* 5000 BC) a variety of cloth types were being produced.[2] These textiles range in quality from coarse to very fine.

The production of linen cloth

The production of linen involves several essential stages, including the sowing and harvesting of the flax seeds; spinning and the last major task in the process, the weaving of the cloth itself.[3] The full process can be summarised as follows:

. the flax seeds are sown
. when the plants are mature they are picked, bundled together and allowed to dry in the sun
. once dry the seed heads are removed and the flax plants are placed in water in order to rot the hard, outer coat of the stems, so freeing the long lengths or bundles of flax fibres which lie inside. This process is called *retting*
. after the outer coat has rotted away, the flax is allowed to dry once more, before it is sent to the spinning workshop
. one of the first jobs in the spinning workshop is to remove any bits of hard stem or core from the flax plant. This is sometimes done by passing the flax fibres between a block and a large wooden 'sword', or between two sticks held in the hand (*scutching*)
. once the flax fibres are clean from any impurities, they are loosely twisted together into long lengths (*roves*) and then rolled into a large ball or coil
. the balls are then given to other spinners who twist or spin the length of fibres into a thread
. the thread on the spindles are then unwound either onto special frames or into balls prior to the yarn being passed on to the weavers
. the yarns are given to the weavers who weave them into long lengths of cloth

---

[1] See for example, Knudtzon 1915:119; Janssen 1975:492.

[2] Caton-Thompson and Gardner 1934:40, 43, 46, 49, 51, 90.

[3] For a general introduction to production of Egyptian textiles see Crowfoot 1931; Roth 1951, Allgrove-McDowell 1986 and Hall 1986.

. finally, the cloth is washed and bleached white by drying it in the sun

The archaeological evidence for the production of textiles in Pharaonic Egypt

Virtually every site excavated in Egypt has produced evidence in some form or other for the production of cloth. In most cases the evidence includes the ubiquitous spindle whorl. In other cases there is evidence for complete spinning and weaving workshops.[4] However, many objects that were used in the textile production process are difficult to identify, and it is inevitable therefore that in the past many tools were discarded or incorrrectly described. On the other hand, in some cases the reverse seems to have occurred and items were attributed to the production of cloth which have nothing to do with it. In order to help redress this situation this booklet contains information about the range of textile related artifacts that may be found either in a museum collection or during an archaeological excavation.

Representations of textile production scenes

Although there is no single representation of the whole process of textile production, the story of how cloth was produced in Pharaonic Egypt can be deduced from a series of tomb paintings and models. The most important are given in Table 1. Yet, care has to be taken with these representations, since they may not always represent reality. In addition, certain of the tomb models have been reconstructed in modern times with varying degrees of accuracy, and sometimes it is not easy to be certain about what is original and what is new. Wherever possible the new should be treated with as great a degree of caution as the old. Despite such problems, however, it is possible to follow the main lines of textile production in Pharaonic Egypt from these and similar sources.

The spelling of personal and place names are based on those used by J. Baines and J. Malek, in *Atlas of Pharaonic Egypt*, 1980, Oxford.

Finally, I should like to thank R. Germer and B. Lok-Knap for reading through this booklet at the manuscript stage and for making their numerous, helpful comments

[4] See for example, German finds at in the Main City at Amarna, Borchardt 1907:27-28.

Table 1
Tomb paintings and models depicting spinning and weaving scenes
(all dates are approximate)

Tomb paintings[5]

tomb	*location*	*date*
Amenemhat	Beni Hasan 2	12th Dyn.
Khnumhotpe III	Beni Hasan 3	12th Dyn.
Baqt	Beni Hasan 15	11th Dyn.
Khety	Beni Hasan 17	11th Dyn.
Tehuti-Hetep	Deir el-Bersha	12th Dyn.
Daga	Thebes, TT 103	12th Dyn.
Thut-Nefer	Thebes, TT 104	18th Dyn.

Tomb models[6]

model	*provenance and location*	*date*	*present location*
spinning and weaving workshop	tomb of Gemniemhet Saqqara	9th Dyn	Glypotothèque Ny Carlsberg Copenhagen, A516
spinning and weaving workshop	tomb of Karenen	10th Dyn.	Egyptian Museum Cairo, no acc. no.
spinning and weaving workshop	tomb of Usermut and Anpuemhet, Saqqara	11th Dyn.	Egyptian Museum Cairo, no acc. no.
spinning and weaving workshop	tomb of Meket-Re Deir el-Bahri	11th Dyn.	Egyptian Museum, Cairo, 46723
spinning and weaving workshop	tomb near Girgeh Upper Egypt	12th Dyn.	Metropolitan Museum of Art, New York, 30.7.3

[5] Newberry 1893, I, pls. XI, XXIX; 1894, II, pls. IV, XIII; Davies 1913:34-35, pl. XXXVII; Davies 1929:239.

[6] Firth and Gunn 1926, I, 53; II, pl. 28:c; Mogensen 1930:68, pl. LXVI; Quibell 1908, II, 75, pl. XVIII,2; Quibell and Hayter 1927:42-43, pl. XXVI, i; Winlock 1955:29-33; Clark 1944:24-29. For a list of spinning and weaving models see Breasted 1948:52-55.

SOWING AND HARVESTING THE FLAX

Flax is a member of the *Linaceae* family of which there are twelve genera. Although the genus *Linum* has 230 species, only a few are of use for the production of textiles (Catling and Grayson 1982:13). *Linum* is an annual herb with alternating, lanceolate leaves along the entire length of the stem (fig. 1). The flowers have five petals which may be white, blue or purple. The fruit consists of a capsule that encloses ten seeds.

Fig. 1 Flax plant (after Jávorka 1979, no. 2222)

Linum L. is a relatively large genus comprising some 200 species. It grows throughout the temperate, Mediterranean and steppe belts of the northern hemisphere (Zohary and Hopf 1988:114). Flax, however, is not native to Egypt, although its use dates back to the Prehistoric period. According to Germer it is possible that it was imported into Egypt from the Levant (Germer 1985:101). Two types of flax are believed to have been known in Predynastic Egypt. Cultivated flax *Linum ustitatissimum* L, which is closely realted to wild *L. Bienne* Mill (syn *L. angustifolium* Huds) and *L. bienne* which is now identified as the wild progenitor of *L. usitatissimum* (Zohary and Hopf 1988:115).

Linum bienne Mill grows to a length of one metre and has small, white flowers. A flax capsule (3000/3) was found at the Prehistoric site of Badari by G. Brunton. It was described

as being smaller, with deeper ridges than the more common *Linum usitatissimum* (ex *Linum humile*) and it is therefore possible that it was of the *bienne* type (Brunton and Caton-Thompson 1928:63).

Linum usitatissimum grows to about one metre high, but it has small, light blue flowers. It is this form of *linum* which became the main source of flax during the Pharaonic period. In some tomb paintings flax flowers are represented by a line of blue paint.[7] This would indicate that the artists were depicting *Linum usitatissimum*, rather than *bienne*.

Flax seeds of the *L. usitatissimum* type have been found at numerous sites in Egypt, including prehistoric sites in the Fayum. For example, a flax seed from silo 59 in the Upper Granaries area of Kom K was identified as *L. usitatissimum* (Caton-Thompson and Gardner, 1934:46).

The structure of flax

In order to understand the various processes described in this booklet it is first necessary to study the nature of the flax stem. The stem of the flax plant is made up of several layers (figs. 2a-b; after Catling and Grayson 1982:13-15, figs. 3-4). Of importance to the production of flax are the fibre bundles (pericyclic fibres) which lay between the epidermis and cortex, and the phloem. The bundles contain between 20 and 80 fibre cells or ultimates separated by narrow girders of parenchyma cells. These fibres are used to make cloth. In order to release the fibre it is necessary to break down and remove the other layers of cells. This process will be described in the section on the preparation of fibres for spinning.

Sowing the flax seeds

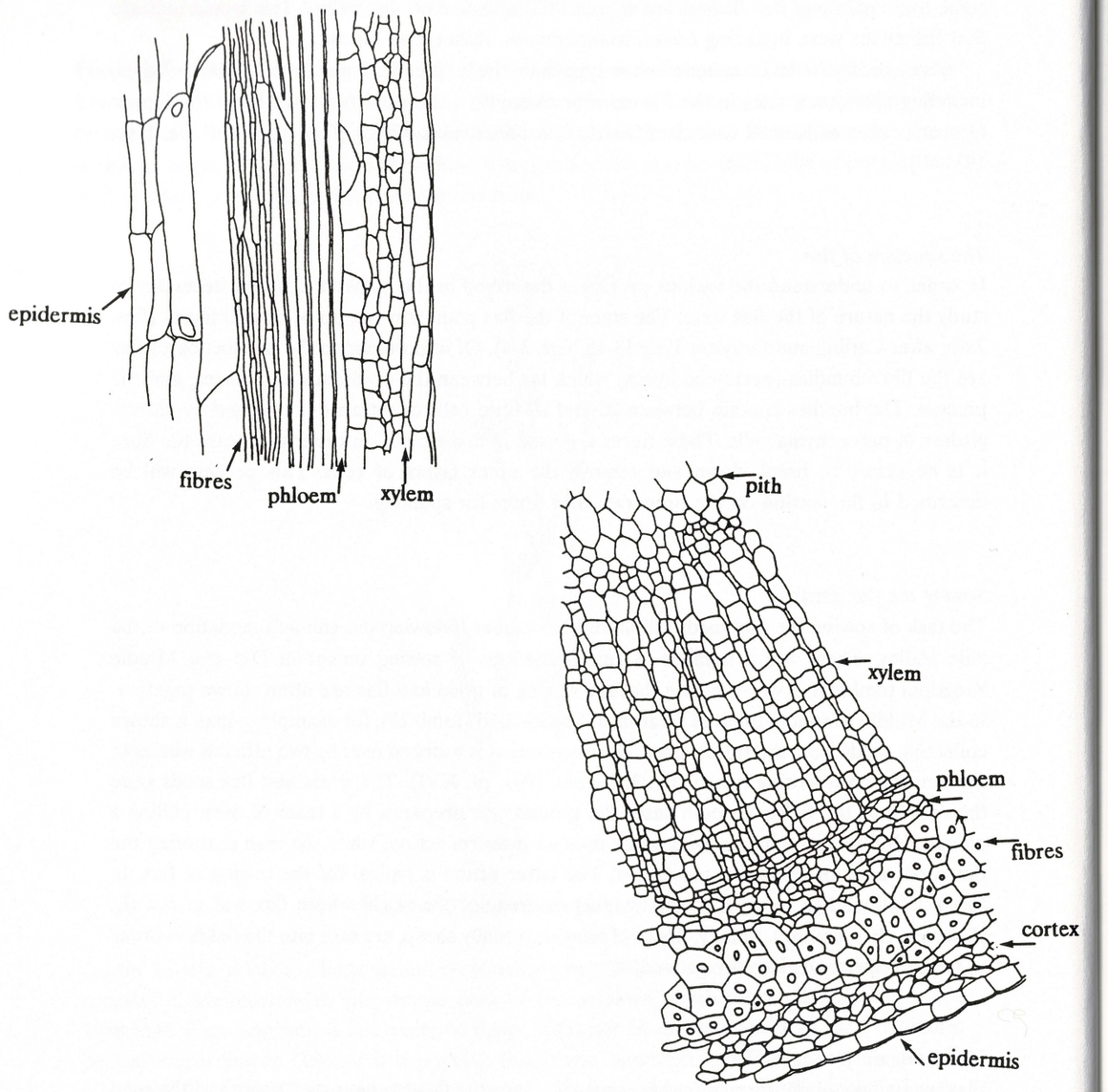
The task of sowing the flax seeds fell in mid-November following the annual inundation of the Nile Valley. There are a number of representations of sowing scenes in Old and Middle Kingdom tombs. It is worth noting that the sowing of grain and flax are often shown together. In the Middle Kingdom tomb of Urarna, at Sheikh Saïd (tomb 25), for example, a man is shown collecting seeds from the storerooms. The distribution is watched over by two officials who note the amount on a writing board (fig. 3; Davies 1901, pl. XVI). The grain and flax seeds were then taken to the fields. In both cases the ground was prepared by a team of oxen pulling a plough. However, the man sowing grain uses an overarm action, while the man scattering the flax seeds uses an underarm movement. The latter action is typical for the sowing of flax. In fact it continued to be used to this century in areas of the world where flax was grown (L. Heinrich, pers. comm.). Finally, flocks of animals, usually sheep, are sent into the fields in order to trample the seeds into the ground.

Harvesting the flax seeds

Flax plants take about three months to mature. Once the flowers have died away and the seed heads appear, the plants are nearly ready to be harvested. The exact time that the flax plants are pulled is of great importance, since the plant's age affects the uses to which the fibres can

[7] See for example, Howard 1930:186 fig on inside of cover, depicting a 6th Dynasty relief of a flax harvesting scene, The relief is now in the Cleveland Museum of Art, acc. number not available at present.

be put. For example, if the flax plants are pulled while still young and green then a fine textile can be produced; if it is pulled when slightly older then the fibres are suitable for a general, good quality cloth. If, however, they are pulled when the plants are old then the resulting flax is usable for coarse cloth and ropes (Lucas and Harris 1964:143).



Figs. 2a-b Longitudinal and horizontal structure of the flax plant (after Catling and Grayson 1982:13-15, figs. 3-4)

According to various Egyptian representations of flax harvesting scenes both men and women were involved in the process. In each case a bundle of flax stems is grabbed in both hands and then pulled out of the ground, rather than cutting it with a sickle as in the case of wheat. Flax is pulled rather than cut in order to get as long and straight a length of fibre as possible. The flax plants are then tied into bundles and allowed to dry in the sun. This process can be seen in the tomb of Urarna mentioned above, which shows men pulling the flax and bundles of flax drying in the sun, and in the near contemporary tomb of Paheri at el-Kab where the flax is being pulled by both men and women while another man is tying the flax into bundles (figs. 4 and fig. 5).[8]

Removing the seed heads

After the flax plants are thoroughly dried the seed heads have to be removed. Several different methods of stripping or *rippling* the heads are possible, for example, they may be removed by hand. Another method is shown in the tomb of Paheri mentioned above, where the flax stems are pulled between the 'teeth' of a long board or rippling comb (fig. 6; Tylor and Griffith 1894, pl. IV). The seeds fall into a pile around the base of the board. A similar board, but this time shown with a stand, is represented in the New Kingdom tomb of Menna (fig. 7; Petrie 1914, opp. 49). The seeds were saved for their oil (linseed oil) and possibly as a food source for animals (Germer 1985:100-101).

In the scene shown in Figure 5, from the tomb of Paheri, an old man is boasting that he could deseed any amount of flax; the younger man is telling him to be quiet and to get on with his work (Tylor and Griffith 1894:14):

"If you bring me 11009 [bundles], I'm the man to strip them all"

"Quick, do not chatter, you old quack of a labourer"

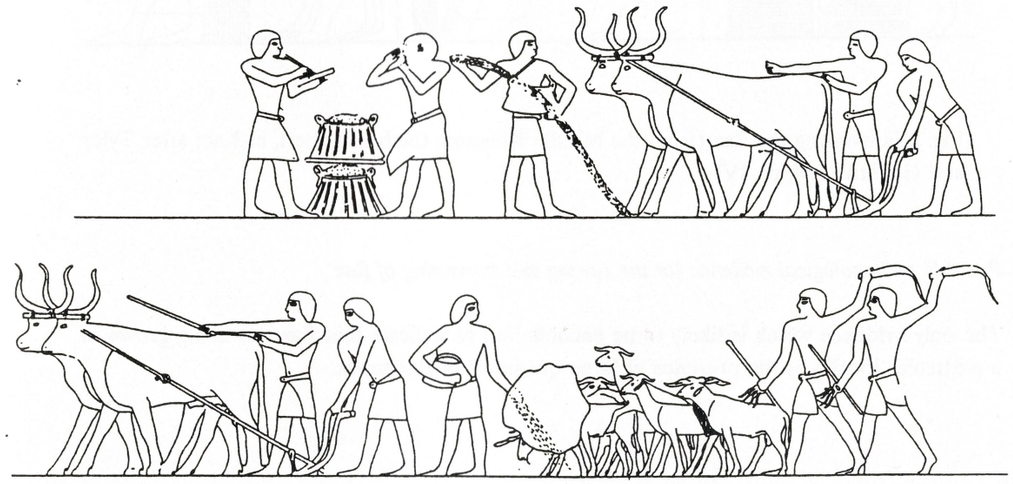


Fig. 3 Collecting grain seeds and the scattering of grain and flax seeds (from the Middle Kingdom tomb of Urarna, Sheikh Saïd; after Davies 1901, pl. XVI)

[8] Davies 1901, pl. XVI; Tylor and Griffith 1894, pl. IV.

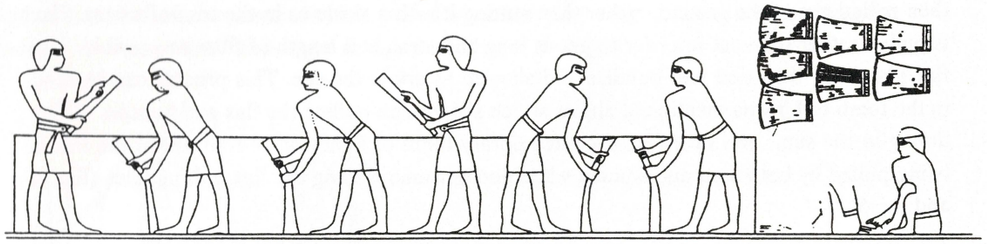


Fig. 4 The harvesting of flax (from the Middle Kingdom tomb of Urarna, Sheikh Saïd; after Davies 1901, pl. XVI)

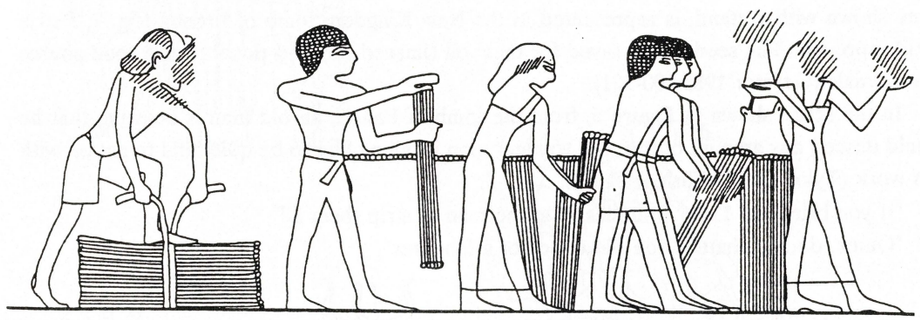


Fig. 5 Harvesting the flax (from the Middle Kingdom tomb of Paheri, el-Kab; after Tylor and Griffith 1894, pl. IV)

Possible archaeological evidence for the sowing and harvesting of flax

The only evidence which is likely to be encountered to indicate that flax was being grown in a particular locality is the presence of large quantities of flax seeds.

Fig. 6 Rippling board from the tomb of Paheri, el-Kab (after Tylor and Griffith 1894 pl. IV.

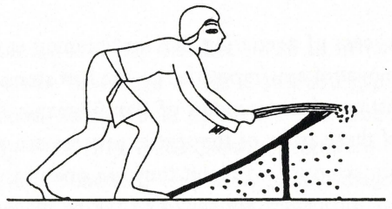


Fig. 7 Rippling board from the tomb of Menna, Thebes (after Petrie 1914, opp. 49.

PREPARING THE FLAX FOR SPINNING

The process of preparing flax for spinning can be divided into two separate activities. Firstly the removal of any impurities on the flax stems (*retting* or cleaning and *scutching*) and secondly the twisting of the bundles of flax filaments into rough, or preliminary 'sausages' or *roves*. Both of these parts of the textile process are somewhat vaguely depicted in tomb models and representations. As a result they are open to various interpretations. In general, however, the following processes appear to be taking place:

Retting

After the seed heads have been removed it is necessary, at least in theory, to rot or *ret* the flax stems in order to remove the hard outer bark or cortical tissue of the plant. Normally, flax is placed into slowly running water to complete this process. The length of time the stems remain in the water is dependent on the type of flax and the temperature of the water, but between ten and fourteen days would seem acceptable.[9]

It has been suggested by various authors that the garden scene in Figure 8 represents part of the processing of flax, namely the retting of the plant stems in pots set into the ground.[10]

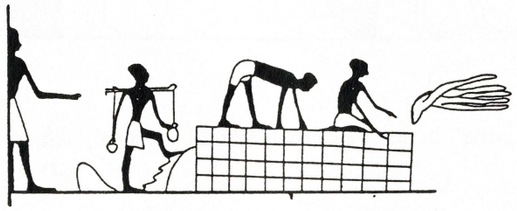


Fig. 8 A Pharaonic Egyptian garden scene from Beni Hasan, sometimes incorrectly described as depicting retting ponds or basins (after Newberry 1893, pl. XI)

The 'symbol' shown to the right hand side of the so-called retting basins is actually a bunch of lettuce, which is an indication that gardens rather than retting pots are being represented (Keimer 1924, I, 5).

[9] According to Crowfoot flax was retted in the modern Egyptian village of Nahya for about fifteen days according to the temperature (Crowfoot 1931:32)

[10] One of the earliest examples of this is notion is Newberry 1893:31.

After the outer bark of the flax plants have rotten away the flax is removed from the water and allowed to dry in the sun. Then follows the next stage in the process, namely the preparation of the flax fibres prior to spinning.

Beating

The next stage in the operation consists of beating or bruising the flax stems in order to separate the fibres from the wooden parts of the stem. This stage is not shown in Egyptian representations, but wooden mallets have been found which would serve this task (see for example, Peet and Woolley 1923, pl. XIX:3 (22/102), 4 (22.121). G.M. Crowfoot reported that she saw wooden mallets being used for this task in the modern Upper Egyptian village of Nahya (Crowfoot 1931:34). The flax was laid on a large stone and beaten with the mallets.

Scutching

In order to remove any hard bits left over after retting, the lengths of flax fibres are either beaten with a large wooden fan or bat to shake out all the loose pieces, or they are passed between two sticks held in the hand (*scutching*). This latter technique can be seen in the Middle Kingdom tomb of Daga, Thebes (TT 103), and the New Kingdom tomb of Thut-Nefer, also at Thebes (TT 104; figs. 9 and 10).[11] In the former example the sticks are small, while in the latter they appear to be quite large, but the process remains the same.

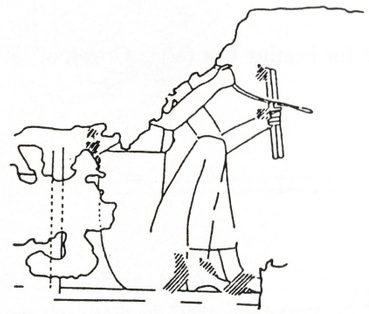


Fig. 9 Scutching scene from the tomb of Daga, (TT 103; after Davies 1913, pl. XXXVII)

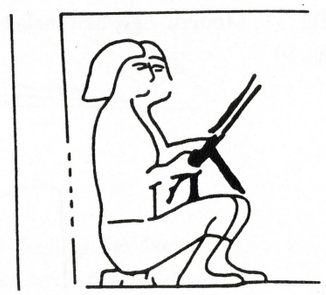


Fig. 10 Scutching scene from the tomb of Thut-Nefer, Thebes (TT 104; after Davies 1929:239)

[11] Based on Davies 1913, pl. XXXVII and Davies 1929:239.

Possible archaeological evidence for the preparation of flax fibres

Retting: It is unlikely that retting pools or ponds can now be identified, unless large quantities of deteriorated bast fibres are found at the bottom of a depression.

Beating: Suitable wooden mallets have been found at numerous Middle and New Kingdom sites in Egypt. It is difficult, however, to determine whether they were used for beating flax or for carpentry (fig. 11). It is necessary, therefore, to be aware of this use of mallets and to take note about the exact findspot of the mallet and any surrounding objects.

Scutching: As there are no contemporary representations of scutching it is impossible to be certain of the exact nature of an ancient bat. However, in Figure 12 a drawing has been given of the object used in the early 1920's in the village of Nahya (after Crowfoot 1931, fig. 9).

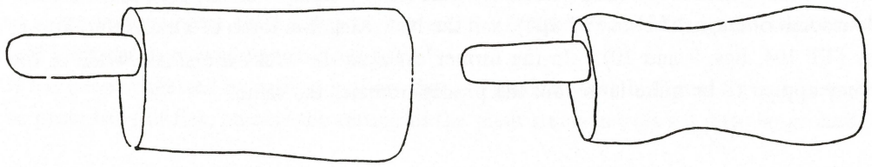


Fig. 11 Modern Egyptian malletsin wood, suitable for beating flax (after Crowfoot 1931, fig. 9)

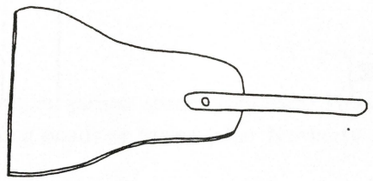


Fig. 12 Modern Egyptian scutching board (after Crowfoot 1931, fig. 9)

SPINNING

As the length of individual fibres can vary in size from about a centimetre (for example, cotton), to more than two metres long (for instance, jute), different techniques have been developed in order to cope with the various fibre types. It would appear from both actual finds and representations of spinning that the technique in Pharaonic Egypt can be divided into two distinct, but related processes. The first involves an initial and loose twist to the flax fibres. The second is the actual spinning of the fibres in order to produce the thread.

Preliminary twisting

Once the fibres have been scutched they are ready for the next stage. The fibres are given to a person, normally a woman, who transforms them into rough, but orderly lengths. These lengths are produced by either rolling the flax threads on the thigh or by rolling the fibres on a semicircular form directly in front of the woman. These forms can be seen in various tombs, including that of Daga, Tehuti-Hetep at Deir el-Bersha and Thut-Nefer at Thebes (figs. 13 and 14).[12]

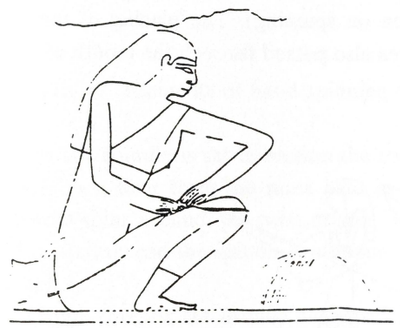


Fig. 13 Rolling flax fibres from the tomb of Daga at Deir el-Bersha (after Davies 1913, pl. XXXVIII)

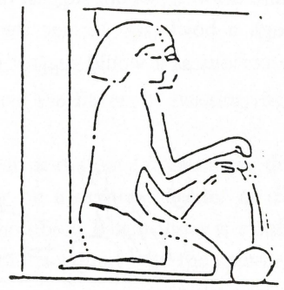


Fig. 14 Rolling flax fibres from the tomb of Thut-Nefer (after Davies 1929:239)

Rolling into balls or coils

The final stage of the pre-spinning process is still uncertain. The roughly spun fibres are either wrapped into balls, as seems to be indicated in the tomb of Khety at Beni Hasan, or they are

[12] Davies 1913, pl. XXXVIII; Griffith and Newberry 1894, I, pl. XXVI and Davies 1929:239.

coiled as depicted in the tomb of Daga at Deir el-Bersha (fig. 15).[13] The latter possibility is purely based on representational grounds, and may not have occurred in reality.

Fig. 15 Coil of semi-twisted thread from the tomb of Daga, Deir el-Bersha (after Davies 1913, pl. XXXVII)

There is an interesting depiction in the tomb of Tehuti-Hotep, Deir el-Bersha, which, as shown in the published line drawing, would suggest that the end of the ball (or coil) of semi-spun fibre was passed through a bowl (fig. 16; see the next section on spinning). The placing of the woman's hands is curious as it would suggest that the fibres also passed through the mouth of

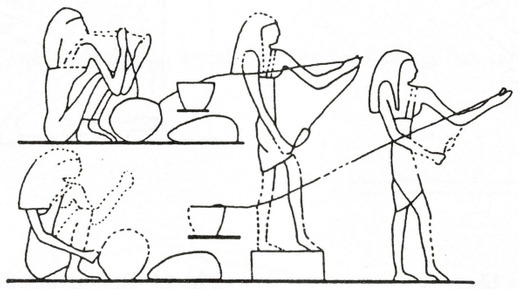


Fig. 16 Semi-spun lengths of thread passing through a bowl from the tomb of Tehuti-Hetep, Deir el-Bersha (after Griffith and Newberry 1894, pl. XXVI)

the woman. In order to produce a coherent thread it is normal for flax fibres to be moistened before being spun. This can be done by wetting the fingers prior to spinning, or by moistening the balls (or coils) of flax. In some areas of the Mediterranean the threads are moistened by

[13] Newberry 1894, II, pl. 13; Davies 1913, pl. XXXVII.

passing them through the mouth so that salvia will set the spin. It was also recorded by Crowfoot that this process was still being carried out in her time by women in certain areas of Upper Egypt and the Sudan (Crowfoot 1931: 34). Indeed, one village was famous for the "women who spin through the mouth" (*ibid*). So it is possible therefore that this particular scene actually depicts the process of adding saliva to the fibres before the final stages of spinning.

Spinning

Spinning is the technique of twisting together a number of fibres into a strong, continuous thread. The act of spinning is made up of three distinct stages, namely: (a) the drawing-out of the fibres (fig. 17); (b) the twisting of the fibres and (c) the winding of the thread.

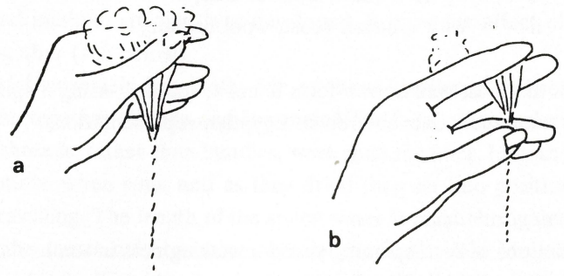


Fig. 17 Elements of hand spinning a) drawing out the fibres; b) twisting the fibres

Once the spindle is set in motion the spinner pulls or draws out (attenuation, drafting) a few fibres at a time from the mass held in the hand or on a separate holder or distaff. As the spindle spins around, the twist or spin is added to the fibres. When there is a sufficient length of twisted thread the spindle is stopped and the thread is wound onto the spindle shaft or into a ball.

Spun threads are usually described as being S-spun (anti-clockwise), Z-spun (clockwise), or I-spun (no spin). The lie of the central bar of each letter indicates the direction of spin (fig. 18). Normally, where two or more spun threads are re-spun (plyed) together, the resulting spin is in the opposite direction to the original spin, for example, an S-plyed yarn may be made up of two z-spun threads (fig. 19).

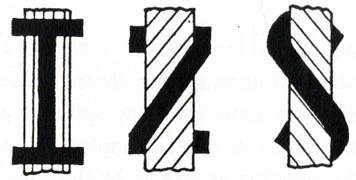


Fig. 18 I, S and Z spin directions

Fig. 19 Plying (S,2z)

Methods of hand-spinning

The type of fibre being spun affects the method of spinning. Consequently, a variety of different methods of spinning has developed. The basic forms are:

1 spinning with the hand using no other equipment (wool or hair)
2 spinning using a weight such as a stone (wool or hair)
3 spinning with a hooked stick (wool or hair)
4 spinning using hands (and feet), plus a spindle (a combination of weight and stick)
  a grasped spindle spinning (bast, wool or hair)
  b supported spindle spinning
    i on the thigh (bast, wool or hair)
    ii on a support or dish of some kind (cotton or silk)
  c suspended spindle
    i by itself (bast, wool or hair)
    ii with a distaff (bast, wool or hair)

Of the above techniques the most well-known form is no. 4, spinning using a spindle, and it is this form which is most commonly encountered in Egyptian representations.

Pharaonic Egyptian spinning techniques

Although there are depictions of men spinning yarn for making nets in tombs dating from the Old Kingdom, it is not until the Middle Kingdom that representations of people spinning thread for cloth are commonly found.[14] Three methods of spinning are shown in various Middle and New Kingdom tomb paintings and models, namely:

a Grasped spindle: a prepared rove is passed through a ring or over a support such as a forked stick and then spun on a large spindle grasped in both hands. This technique is depicted in the tombs of Baqt and Khety at Beni Hasan (forked stick) and the tomb of Thut-Nefer at Thebes (ring; figs. 20 and 21; Newberry 1894, II, pl. IV; Davies 1929:234, fig. 1a)

b Support spindle: the technique involves supporting the spindle while it moves. This process is shown in the tombs of Khety and Baqt at Beni Hasan. In the tomb of Khety, for example, a man is shown sitting back on one heel while drawing a rove from a pot through his left hand and spinning with a spindle held in his right hand (fig. 22; after Newberry 1894, II, pl. XIII)

c Drop spinning: the spindle is rolled on the thigh and then allowed to drop. Scenes depicting this technique are shown in a number of tombs, notably those of Khety and Baqt (fig. 23; Newberry 1894, II, pl. XIII). In some cases the spinners are standing on blocks in order to achieve a greater height. In other examples, they are depicted standing on the floor. Sometimes the spindle was rotated by the spinner

[14] See for example, a man spinning yarn for a net depicted on a relief from a 6th Dyn. mastaba at Saqqara (Firth and Gunn 1926:36).

rolling the spindle on her thigh as can be seen in the tomb of Daga (fig. 24; Davies 1913, pl. XXXVII). In this scene some of the spinners are shown spinning with two spindles at the same time.

The spindle whorl was always at the top of the spindle shaft. So far only a small variety of shapes have been found, most have either a dome or a disc form (see below). The spindle shafts are sometimes slightly bent as they are frequently made out of the rib of a palm branch, which has a natural curve. There is no evidence to suggest that sticks or distaffs for carrying extra fibres were used in Pharaonic Egypt.

Splicing

In recent years more attention has been paid to the process by which the length of the flax thread was increased. In most cases this was done as part of the attenuation process. In Egypt, however, a second method, splicing, was developed. It gives the effect of two s-spun threads being S-plyed together (see below).

In the case of extremely fine cloth, one to three bundles of between three and twenty ultimates are spun together (Cooke and Brennan 1990:9). In coarser cloth, however, it would appear that two threads, rather than bundles, were spun together. In both cases it is likely that the fibres were moist when spun and as they dried they set into position, so preventing the threads from unravelling. The length of the splice varies from about five to twenty centimetres. The use of splicing seems only to occur occasionally in the Old Kingdom, somewhat more frequently in the Middle Kingdom, but by the New Kingdom it is quite common. The use of spliced threads occurs in various types of cloth, both the extremely fine and the relatively coarse. The reasons behind the use of this technique seems to vary. There are instances where it was used to produce an extremely fine cloth. While in the coarse examples it was possibly a method of using up lengths of thread in as economical a manner as possible.

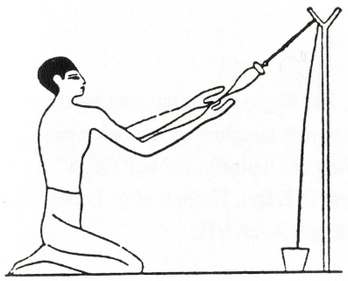


Fig. 20 Grasped spindle, plus forked stick (tomb of Baqt, Beni Hasan, after Newberry 1893, pl. IV)

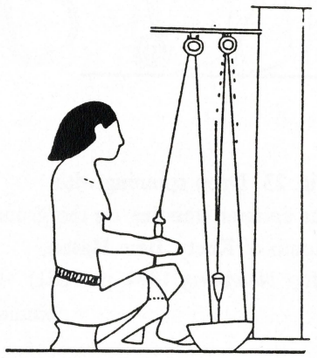


Fig. 21 Grasped spindle, plus ring (tomb of Thut-Nefer; after Davies 1929, fig. 1a)

Fig. 22 Support spinning (tomb of Khety; after Newberry 1894, pl. XIII)

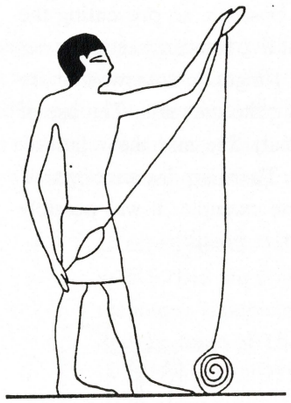


Fig. 23 Drop spinning with the spinner standing on the ground (tomb of Khety, Beni Hasan, after Newberry 1894, pl. XIII)

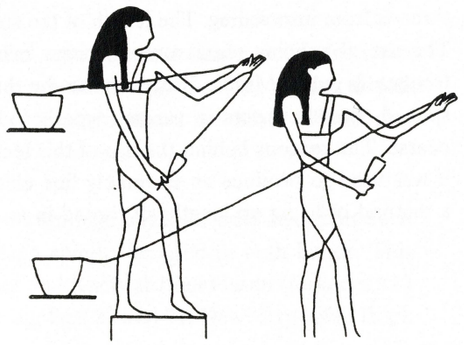


Fig. 24 Drop spinning: one of the spinners is standing on a block while rolling the spindle on her thigh (tomb of Daga, Thebes; after Davies 1913, pl. XXXVII)

Possible archaeological evidence for spinning in Pharaonic Egypt

A limited range of objects are found at various Pharaonic sites in Egypt which can be related to the occupation of spinning. These objects are: spindles (both shafts and whorls); spinning rings and spinning bowls.

Spindles

The remains of spindles form the most widespread evidence for the production of cloth in Pharaonic Egypt (fig. 25). In particular, items described as spindle whorls are ubiquitous. Yet, sometimes objects of an otherwise unidentifiable nature are described as whorls in order to give them a label. Care, therefore, has to be taken when reading reports as to whether a whorl was actually found or not.

It is worth noting that it is not uncommon at settlement sites in Egypt to find spindles associated with roofing material (Vogelsang-Eastwood, in press). This is probably due to groups of spinners working on the roofs of houses, rather than solely indoors.

Spindle shafts: It is rare for complete spindles to be found during an excavation. Normally only the whorl is found (see below) or the whorl and part of the shaft. In many cases the rib of a palm leaf was used to make the shaft. The natural bend in the rib is sometimes left giving the spindle a characteristic, gentle curve.

In many cases it is likely that spindle shafts were found but subsequently discarded as "sticks". Occasionally, however, the worked head of a spindle shaft is found and this makes it easier to identify a "stick" as a spindle shaft. Three types of worked heads are known from Pharaonic contexts, namely, (a) a grooved notch; (b) a knob and (c) an inserted splinter (fig. 26a-c; see for example, Vogelsang-Eastwood, in press).

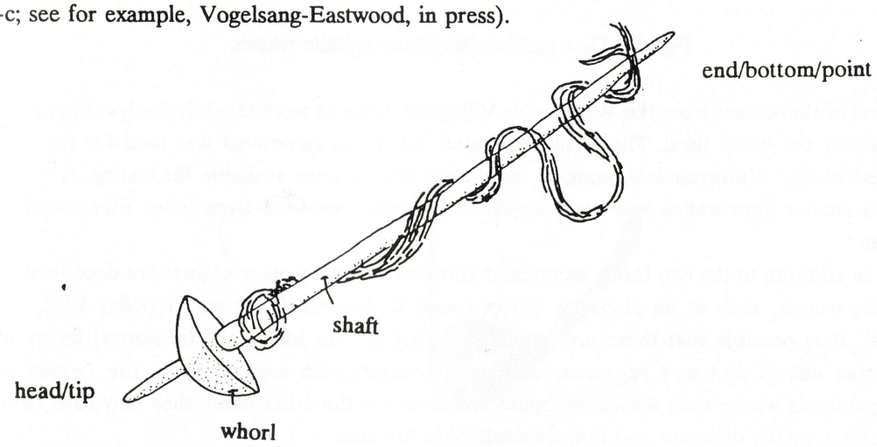


Fig. 25 Elements of a hand spindle

Spindle whorls: Many sites in Egypt have produced spindle whorls. Most are either the disc or domed whorl (fig. 27). The disc form would appear to be the oldest of the two and has been found at Prehistoric sites such as Kom W in the Fayum (Caton-Thompson and Gardner 1934:33). The dome-shaped form appears at the end of the Middle Kingdom and is widespread by the New Kingdom.

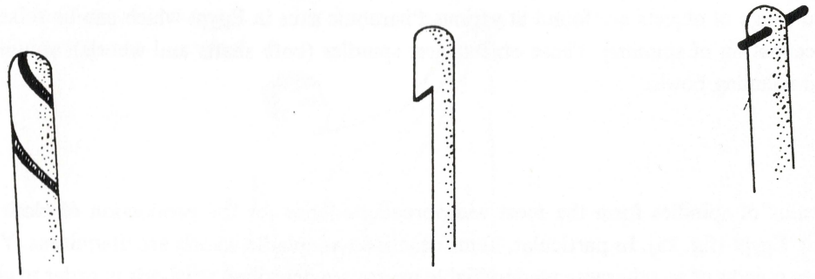


Fig. 26a-c Three types of worked heads from Pharaonic spindles. (a) grooved notch; (b) knob and (c) inserted splinter

Fig. 27 Disc and dome-shaped spindle whorls

Several of the whorls from the Workmen's Village at Amarna were recently analysed in order to identify the wood used. The results indicated that *Ficus sycomorus* was used for the disc shaped whorls. Unfortunately, none of the domed whorls were available for testing. A wood with a similar appearance was used for the disc whorls recorded from other sites, notably, Kahun.

In addition to the two forms mentioned above occasionally other objects are described as spindle whorls, such as an alabaster object found at Amarna (Peet and Woolley 1923, no. 21/59). It is possible that these are whorls, but they do not follow the traditional forms of Egyptian whorls and may represent accidental contacts with areas such as the Levant or Mesopotamia where such whorls are more common. On the other hand, they may have been used for a totally different and now unidentifiable function.

Occasionally whorls are found which have marks cut into the side of the whorl, especially the wooden disc whorls. At Amarna for example, three different marks have been found, namely an elongated V on its side; an X, and a rectangle with two horizontal lines (Vogelsang-Eastwood, in press). A likely explanation for these marks is that they were owner's marks.

Spinning rings

To date, no actual spinning rings have been satisfactorily identified from an excavation in Egypt. However, the use of such rings is depicted in the New Kingdom tomb of Thut-Nefer, Thebes.

So it may be suggested that they did exist, but so far have not been recognized (see fig. 19). A hypothetical ring consisted of a holed disc between 7 and 15 cm in diameter with two small holes at the top (fig. 28). It was probably made out of wood or bone. It is likely that a used disc would have wear marks along the upper edges of the small holes, where the ties were fastened, and along the bottom of the larger disc where the filaments or threads passed through the disc.

Spinning bowls

A spinning bowl is literally a bowl with one or more handles set in the bottom of the vessel (fig. 29). The shape of the bowl can vary from a shallow slope to an upright form. Normally they are made out of clay (usually fired), but occasional stone examples can be found.[15]

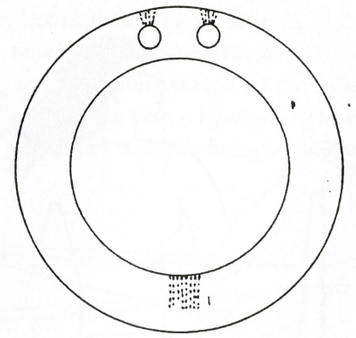


Fig. 28 Spinning ring

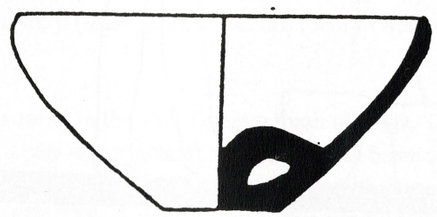


Fig. 29 Form of a typical spinning bowl

The use of spinning bowls can be traced in the Levant and Egypt from Prehistory through to the New Kingdom. In Israel, for example, spinning bowls have been found at Beth-Shean and

[15] Dothan 1963; Vogelsang-Eastwood 1987-88. For a stone spinning bowl, see Peet and Woolley 1923, I, 21, 61, no. 22/591. See also Petrie 1890:25, pl. XIII:58.

Tell Jerische.[16] Similar bowls have been found at Deir el-Ballas, Deir el-Medineh and el-'Amarna in Egypt.[17]

As noted previously, spinning bowls can be seen in Egyptian Middle and New Kingdom scenes and models. The Middle Kingdom model of Meket-Re from Deir el-Bahri (JE 46723), for example, contains three bowls placed behind the spinners (Winlock 1955:29-33, pl. 25-27). In this example, however, the inside of the bowl was not hollowed out and the thread simply came out of the top of the bowl. In another tomb model from the Middle Kingdom, found at Saqqara, the bowl was hollowed out and a handle was carved into the bottom of the vessel (Egyptian Museum, no number available; Quibell and Hayter 1927:42-43, pl. 26). In the Middle Kingdom tomb of Khnumhotpe, Beni Hasan, the spinner has two bowls by her feet, one of which was painted red to represent a ceramic vessel, the other was painted red and white, probably to represent a bowl made from alabaster (fig. 30).

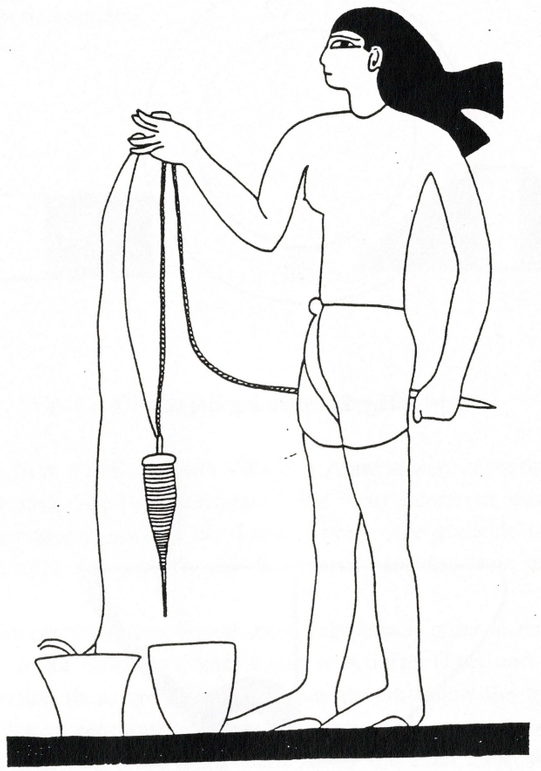


Fig. 30 The Beni Hasan spinner with two bowls at her feet (tomb of Khnumhotpe, BH 3; after Newberry 1900, IV, pl. XV)

[16] FitzGerald 1930:5, 20, pl. XLIV:11, pl. XLI:29; Dothan 1963:99-100 fig.1-5.

[17] Larsen 1941:30-31; Nagel 1938:183-188, figs. 152-155; Petrie 1890:25, pl. XIII:58; Peet and Woolley 1923:61; 137, pl. XLVIII; Nicholson and Rose 1985:135.

PREPARING THE WARP THREADS

After the flax fibres have been spun into a thread or yarn they are ready to be woven into cloth. The first task in this process is to remove the thread from the spindle and to warp (*warping)* the loom. This involves placing the warp threads in position on the loom. Subsequently the threads have to be tensioned. Once this has been done weaving can commence (see the next section).

Warping involves laying threads of equal length in parallel lines. This can be done by stretching them around pegs held firmly in the ground, on a wall, on a warping form or on a revolving warping mill. Three different methods of winding the warp threads ready for warping are represented in tomb models and paintings.

The first and most simplest method is depicted in an 11th Dynasty model from the tomb of Meket-Re, Deir el-Bahri, now in the Egyptian Museum, Cairo (fig. 31). It involves three pegs driven into a wall. The warp thread is either wound off the spindle directly around the pegs or from a previously wound ball. In either case a figure-of-eight shape is created. In the case of the Meket-Re tomb model the thread is shown being unwound directly from the spindle.

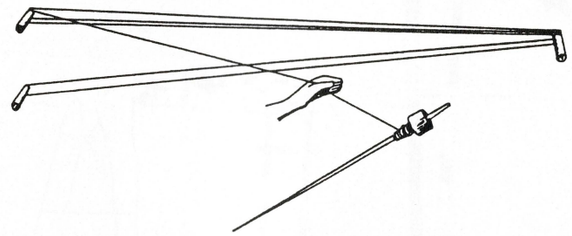


Fig. 31 Preparing a warp (tomb model from the tomb of Meket-Re; after Winlock 1955, fig. 67)

A second method is illustrated in the 11th Dynasty tomb of Daga, Thebes, in which a woman is winding thread round a pair of uprights which have a cross-beam set about half way up each of the stands (fig. 32; Davies 1913, pl. XXXVII). In the 18th Dynasty tomb of Neferronpet, Sheikh 'Abd el-Qurna (TT 133), a similar system was used which involves two stands with paired uprights, but the latter have the appearance of forked branches (fig. 33; Davies and Gardner 1948, pl. 35).

The third method of warping is depicted in the 11th Dynasty tomb of Dhutihotp II, Deir el-Bersha (fig. 34; Newberry, 1893, I, pl. XXVI). It involves balls of thread being placed in bowls or containers of some kind and then groups, perhaps of up to twelve threads in all, being either wound onto a series of pegs driven into a wall in the manner described above, or directly wrapped around the warp and cloth beams of a ground loom (see the next section).

Possible archaeological evidence for the various Pharaonic Egyptian warping systems

Peg frames: Evidence for the first type of winding system will be found in the form of sets of peg holes in walls. It is possible that the pegs will still be *in situ*.

It has been suggested by Peet and Woolley that such peg holes were found on both the internal and external walls of houses at the Workmen's Village, Amarna. These pegs were set in groups of three and appear to be too high up for using to tether animals.

> "Another glimpse into the street-life of the place was given by the presence at various heights in the long blank walls facing the house-doors of holes clearly intended for, or made by, wooden pegs, some of which were actually found fallen to the ground beneath. The purpose of these pegs is showed by the wonderful wooden models found at Der el-Bahri by the American excavators in 1920, wherein women engaged in spinning are seen winding the thread off the spindles on to pegs fixed in the wall of the weaving-room. In many Egyptian villages this is still done to-day" (Peet and Woolley 1923:55)

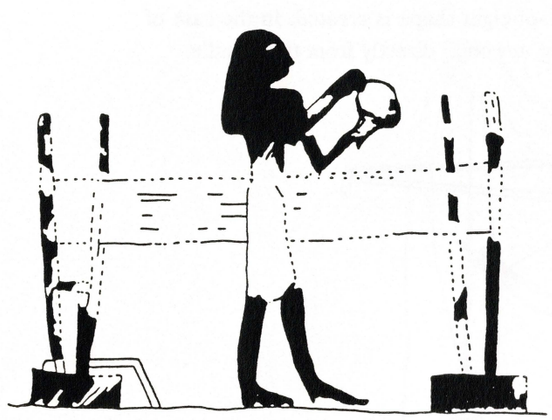


Fig. 32 Preparing a warp (tomb of Daga, Thebes; after Davies 1913, pl. XXXVII)

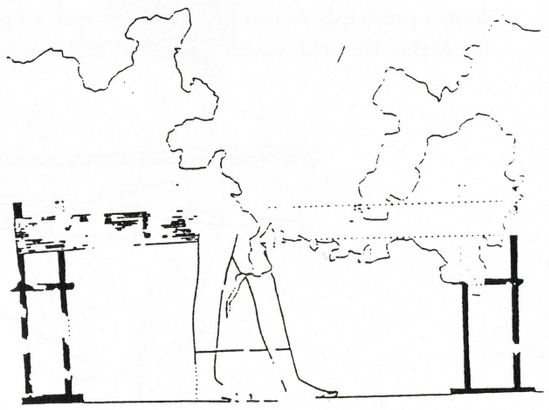


Fig. 33 Preparing a warp (tomb of Neferronpet, Sheikh' Abd el-Qurna (TT 133); after Davies and Gardiner 1948, pl. 35

Warping frames: So far there would be appear to be no complete warping frames recorded from excavations in Egypt. P. Lacovara has suggested, however, that a roughly made emplacement recorded at recent excavations at Deir el-Ballas may have been such a frame (Lacovara 1990:7). As yet, however, this identification is speculative.

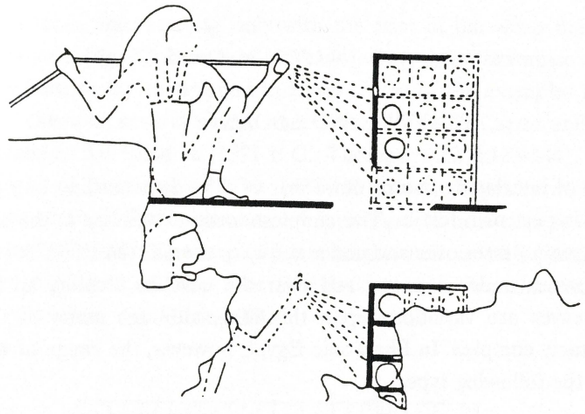


Fig. 34 Third method of warping from the tomb of Dhutihotp, Deir el-Bersha (after Newberry 1893, pl. XXVI)

WEAVING AND LOOMS

Weaving is the process of interlacing two or more sets of threads according to a pre-defined system to produce all or part of a textile. The simplest form of weaving is the tabby weave where one weft thread (*pick*) passes over and under the warp threads (*ends*; fig. 35). In the next row (*throw*) the pick passes under one end and over the next, so forming an interlocking structure. All other weaves are variations upon this idea, although some of the possible variations can be extremely complex. In Pharaonic Egypt, however, the range of weave forms seems to be limited to the following types:

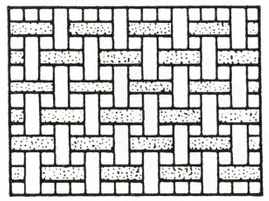


Fig. 35 Tabby weave

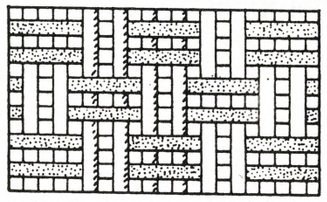


Fig. 36 Basket weave

Tabby weaves: The tabby weave is the basic binding system or weave based on a unit of two ends and two picks, in which each end passes over one and under one pick. The binding points are set over one end on successive picks (Burnham 1980:139). Examples of tabby weave cloth have been found at various prehistoric sites in Egypt, notably sites in the Fayum. The oldest known example of Egyptian cloth from the Fayum A culture is woven in this weave (Petrie Museum, London, UC 2943). It dates to about 5000 BC. Various forms of tabby weave have been found in Pharaonic Egyptian contexts. The most common are simple or balanced tabby weaves; warp-faced tabby weaves and weft-faced tabby weaves.

Basket weaves: A basket or extended weave is a tabby weave in which the warp ends or weft picks move in groups of two or more (fig. 36). Several different forms of basket weaves have been recorded, most of these, however, are New Kingdom in date. The following forms of basket weave were recorded from the Workmen's Village, Amarna: half basket (paired warp threads, single weft-threads); full basket weave (paired warp and weft threads); warp-faced basket weave (single warp and weft threads); weft-faced half-basket weave (paired warp threads, single weft threads) and warp-faced half-basket (paired weft threads and single warp threads; Vogelsang-Eastwood, in press).

Tapestry weave: Tapestry is a weave which comprises of one warp and a weft. The latter is composed of threads of different colours which do not pass from selvage to selvedge but are

carried back and forth, interweaving only with the part of the warp that is required for a particular pattern area (fig. 37; Burnham 1980:144). Only a few examples of textiles woven in a tapestry weave have so far been found in Egypt. Most of the examples are associated with royal tombs. For example, several pieces were recorded by H. Carter and P.E. Newberry, in the tomb of Thutmosis IV (died *ca.* 1391 B.C.; Thompson 1904:143-144). One of the textiles bears the cartouche of Amenophis II (*ca.* 1427-1401; *ibid.*). Tapestry woven items have also been found in the tomb of Tut'ankhamun, for example, a bow case or quiver (Carter 48x; Egyptian Museum 61570) with a pattern of papyrus buds and one of the gauntlets (Carter 46cc; Egyptian Museum 62674). In addition, several of the bag-tunics from the tomb included tapestry woven patterns (Crowfoot and Davies 1941).

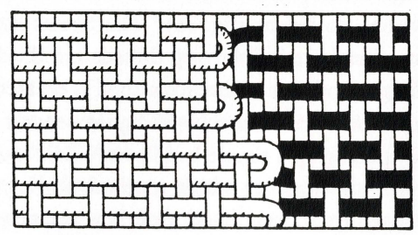


Fig. 37 Tapestry weave

Warp-patterned weave: A small number of textiles with woven patterns have been found in royal circumstances (see below). This type of cloth has been various described as being woven in a double weave; compound weave; tablet weave or a warp-pattern weave.[1] It is one of the most complex of the weaves used in Egypt during the Pharaonic period. Little work has been done on this type of cloth and its exact nature is still uncertain. For this reason, I have simply described it as a warp-patterned weave.

Relatively few details are known about its history. In general it is believed to be an imported form. So far it has only found in royal or semi-royal contexts dating to the New Kingdom.[2] For example, a braid from a saddlecloth was found on a horse's mummy, belonging to Hatshepsut's favourite, Senmut.[3] Several examples have also been found in the tomb of Tut'ankhamun, for example on one of his elaborate bag tunics which was also embroidered (Crowfoot and Davies 1941). One of the largest examples of this type of work is the so-called girdle of Ramesses III, now in the Liverpool Museum (M 11156). It measures 5.2 metres in length and tapers from 12.7 cm to 4.8 cm in width. The "girdle" is ornamented with zig-zags,

[1] This type of weave is called double weave by Roth (1951:27-28); warp pattern weave (Riefstahl 1940:22); Hall describes it as a compound weave (Hall 1986:46).

[2] For a summery of textiles made in this type of weave found in Pharaonic Egyptian contexts, see Riefstahl 1940:20-27.

[3] Now in the Egyptian Museum, Cairo, acc. number unavailable. Lansing and Hayes, 1937:10-11, 14, figs. 14-15.

dots and rows of *ankh* signs in blue, red, yellow and undyed flax. The narrow end bears a faded black ink cartouche and a second regnal year date of the king (*ca.* 1193 B.C.).

Looms

It is known from a variety of written and representative sources that by the 18th Dynasty two basic types of looms were in use in Egypt, namely, the ground or horizontal loom and the vertical or fixed-beam loom.

Ground or horizontal loom

This type of loom has a simple construction and merely consists of a horizontal warp which has been stretched in its length between two beams (fig. 38).[4] The beams are generally kept in place by a pair of pegs driven into the ground. The warp threads are divided into two sets: 1 3 5 7 9 etc, and 2 4 6 8 etc. By lifting up one set of threads a shed is created, the first of which is called the *natural shed*; the *countershed* is obtained by lifting the second set of threads. The countershed is normally created by pulling up a simple heddle or heddle rod. The weaver starts at one end of the warp and works until the other end is reached, moving the position of the heddle as needed. Several suggestions have been made as to how the newly woven cloth was stored on this type of loom. Roth has suggested that it was either wrapped around the cloth beam or the weaver worked down the length of the warp leaving the woven cloth bare (Roth 1951:13, fig. 12). De Jonghe, however, suggested that the warp was looped around the two (warp and cloth) beams in a manner similar to that shown in Figure 39 (De Jonghe and Pollet 1985). In view of the various methods of warping, depicted in Figures 32-34, I think that Roth was correct.

One of the oldest Near Eastern representations of this loom is on a Predynastic bowl (Badarian period; 4500-4000 BC; UC 9547) which was found in a woman's tomb (3802) at Badari in Lower Egypt by G. Brunton and G. Caton-Thompson in the early 1920's (Brunton and Caton-Thompson 1928:54, no. 70k, pl. XLVII).

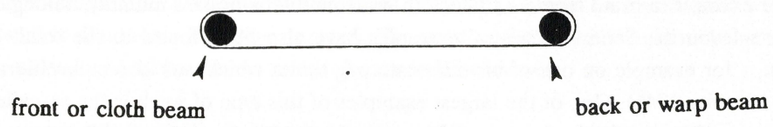


Fig. 39 A continuous warp wrapped around the warp and cloth beams

More detailed depictions of the ground loom can be found in three 11th and 12th Dynasty tombs at Beni Hasan in Middle Egypt (nos. 3, 15 and 17; Newberry 1893, I, pl. XXIX; II, pls.

[4] For a detailed discussion of the various depictions of horizontal looms, see Roth 1951:3-15.

IV, XIII). In addition to these painted representations of the horizontal loom, a number of similarly dated tomb models have survived which include women working on this form of loom, for example an 11th Dynasty weaving workshop from the tomb of Meket-Re at Deir el-Bahri (Winlock 1955, pl. 25-27).

The ground loom continues to be used to the present day in various, more remote regions of the Near East, although in recent years its use has declined. In the Sudan, for example, a virtually identical loom was used within the last fifteen years for the production of long lengths of coarse cloth (Picton and Mack 1979:59-62). Berber women of the Ayt Yazza tribe in Morocco still use a horizontal loom similar to, although not identical with, the ancient form described above (*idem*). One reason given for the survival of this type of loom is that it is suitable for the life of nomadic people because it can be easily packed and later reassembled.

The range of cloth which can be produced easily on the ground loom includes both the tabby and basket weaves.

The length of cloth woven on the ground loom is limited only to the amount of thread spun, as the web of warp thread to be woven was simply wrapped around the warp beam and unwound as needed. Thus it was not necessary to have the two sets of pegs set far apart in order to weave long lengths of cloth.

One of the features of cloth woven on the ground loom is a selvedge fringe which always appears on the left-hand side of the cloth (see fig. 38). Depictions of people wearing cloth with such fringing are common in Middle Kingdom representations, but not so frequently in New Kingdom depictions.

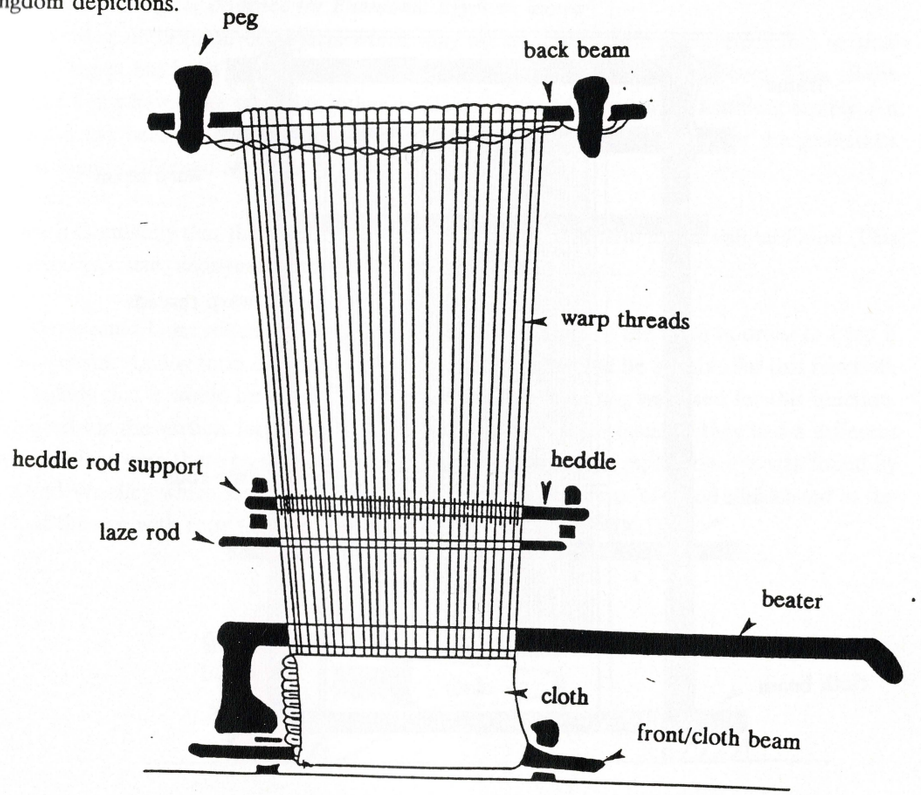


Fig. 39 Elements of a ground loom (after Roth 1951, fig. 6)

Vertical or fixed-heddle loom

The second form of loom depicted in various Pharaonic tombs is the vertical loom (fig. 40). As the name suggests, instead of the warp being stretched horizontally as with the loom described previously, they are tensioned vertically. The warp ends are wrapped around two beams (the top or warp beam, and the lower, breast or cloth beam). The loom is placed either vertically or lent against a firm object such as a wall. The lower or cloth beam can be fixed into position by one of a variety of methods; for example, by placing it in a slight shallow in the ground; resting it in grooves cut out of heavy blocks, or perhaps by fixing it to the ceiling of a room. The weavers stood or sat at the base of the loom and worked upwards. The warp was released during the process of weaving either by turning the top or warp beam, or by lowering the top beam. The size of these looms seems to vary. For example the two looms depicted in the 18th Dynasty tomb of Thut-Nefer at Thebes are of different heights (fig. 41; after Roth 1951, fig. 9). Judging from the size of the weavers, it is possible that the upright beans were between three and five metres in height. But this should be regarded as speculation until actual examples are found.

The vertical loom has been depicted in several 18th Dynasty tombs, most notably the tomb of Thut-Nefer at Thebes mentioned above. The appearance of this loom during the New Kingdom period has led to the hypothesis that it was introduced as a result of the Hyksos invasion of the mid-seventeenth century B.C. As yet, however, there is no direct evidence of this, nor is there anything to indicate that the Hyksos people actually used this type of loom.

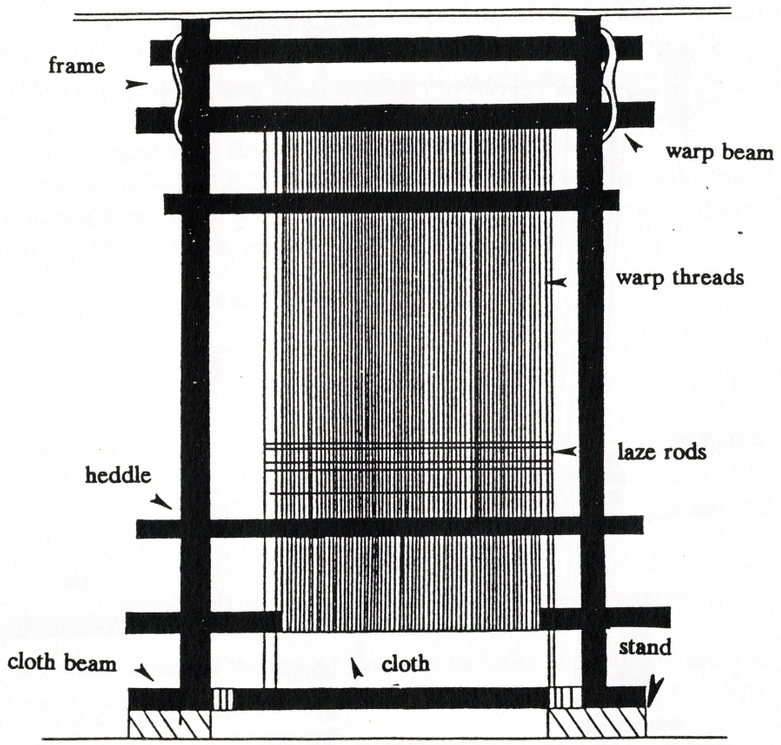


Fig. 40 Elements of a vertical loom (after Roth 1951, fig. 9)

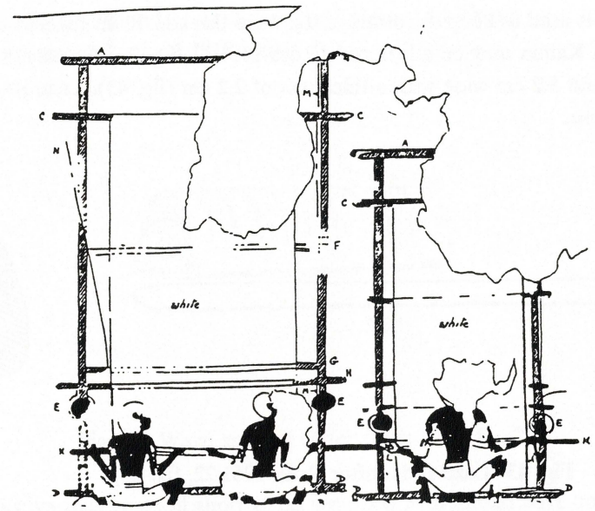


Fig. 41 Single and double vertical looms from the tomb of Thut-Nefer, Thebes (after Roth 1951, fig. 9)

Possible archaeological evidence for Pharaonic Egyptian looms

The following description of objects which may be associated with the ground and vertical looms in Egypt has been given according to type rather than to function or loom. Thus all the stick-like items have been placed together, while more complex forms are listed separately. An indication has been given as to whether the object could have been used for the ground or vertical loom, or indeed for both of them.

Beams: it is unlikely that the beams of either the ground or vertical looms will be found. This is due to their size, anonymity and the scarcity of wood in Egypt.

Pegs: the ground loom requires four pegs, one for each corner of the loom in order to keep it under tension. As any form of stout stick or piece of wood would be suitable for this function, it is unlikely that it would be possible to say that an individual peg was used for this function. Pegs used for the vertical loom may be identified in some cases because they had a different function: they were there to support the heddle. A peg with a large, hollow eye was found by Peet and Woolley which may be such a heddle peg. It is made out of wood and bound at the neck of the eye with rope (fig. 42; Peet and Woolley 1923, pl. XIX:1).

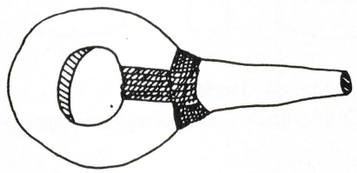


Fig. 42 Heddle peg (after Peet and Woolley 1923, pl. XIX:1)

Laze rods: a laze rod is used to keep the order of the warp threads. Roth suggested that a long, straight lath found at Kahun may be a laze rod (Roth 1951:22, fig. 20). It has notches at both ends and is 124 cm and 5.2 cm wide with a thickness of 2.2 cm (fig. 43). Laze rods were used for both types of looms.

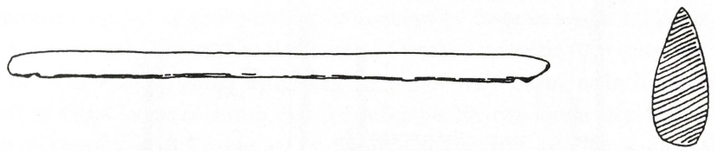


Fig. 43 Laze rods (after Roth 1951:22, fig. 20)

Heddles: a heddle is usually made up of one or two sticks which have a row of long loops attached to them (fig. 44). The depiction of the Beni Hasan loom would suggest that only one stick was used, but this evidence is not conclusive. Heddles were used for both types of looms. So far no objects seem to have survived which could be satisfactorily described as a heddle. So in Figure 44 I have given a tentative reconstruction of what an Egyptian heddle may have looked like, but it should be stressed that this is a hypothetical heddle only.

Warp spacers: several sites have produced lengths of wood which have notches cut into them at regular intervals (fig. 45). It was suggested by Petrie that such an object from Gurob may have been used to keep groups of warp threads at the correct distance from each other (Petrie, 1917, pl. LXVI, nos. 133-135). According to Roth it is likely to be Roman in date (Roth 1951:23). However, similar items have been found at the 18th Dynasty site of Amarna, so it would seem to have a much longer history than indicated by Roth (Peet and Woolley 1923:XX:3). It is not clear, however, whether this type of object was used for the ground or vertical loom, or even both.

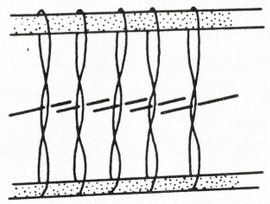


Fig. 44 Heddle

Balls of thread: balls of thread have been found at various Egyptian sites. It is possible that the thread on such balls was intended for the warp on a loom (Peet and Woolley 1923, pl. XIV:7).

Sometimes the balls are wound around pieces of pottery which act as a foundation for the thread (see for example, Cartland 1918:139).

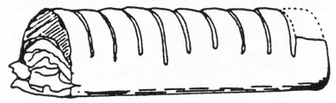


Fig. 45 Warp spacers (after Roth 1951, fig. 23)

Shuttles or spools: various types of short sticks wrapped with thread have been recorded from Egyptian sites, and it is likely that these were shuttles or spools (see for example, Peet and Woolley 1923, pl. XX:3). In most cases the threads are fine and likely to have been used for the weft.

Heddle rod supports or jacks: these are perhaps the most prominent feature of a ground loom. They were used for supporting the heddle when the countershed was created. Two heddle rod supports were used, one on each side of the loom. It is likely that large stones were sometimes used for this purpose, but finds from various sites in Egypt, including those from Kahun, have shown that wooden supports were also made (fig. 46).[5] These vary in size from about twenty to forty centimetres in height and have a large notch cut out of one side on which the heddle rod rested.

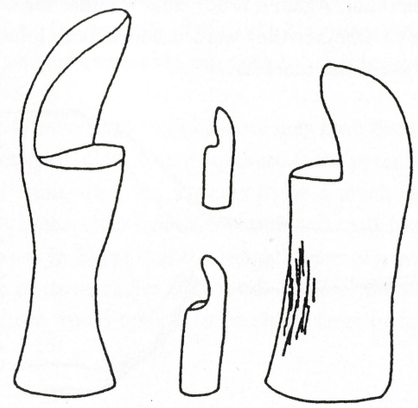


Fig. 46 Heddle rod supports (jacks; after Roth and Crowfoot, 1921, fig. 4)

[5] Petrie 1917, pl. XLIX, nos. 230-233; Roth and Crowfoot 1921:97-101.

Weaving sticks or swords: a number of sticks have been found which were used to beat in the weft thread after it has been passed through one of the sheds (fig. 47). These are commonly called sword beaters after their shape. In most cases one side of the long edge has become worn and shiny due to constant contact with the warp. According to the representations of swords in various tombs at Beni Hasan and Thebes, the shape and size of such sticks can vary considerably (see for example, figs. 38 and 40). It is not clear whether the stick form was used only for the ground loom, while the sword was applied for the vertical loom, or whether they could be used for either.

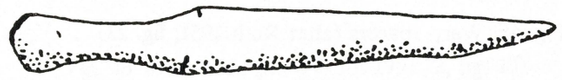


Fig. 47 Weaving sticks or swords (after Peet and Woolley 1923, pl. XXII:1)

Weaver's comb, weaving combs or beater-in: several large wooden combs have been found at various Pharaonic sites in Egypt which were probably used to beat in the weft threads (fig. 48). It should be noted, however, that there is some doubt about their exact age and it has been suggested that they may be Roman in date (Petrie 1917, pl. LXVI, nos. 148, 149, 153). Weaver's combs are usually about 20 cm long, 10 cm wide and about 4 cm thick with teeth cut into one end, and a handle placed at the other. Again it is not clear whether the use of these combs was restricted to one type of loom or whether they were used for both looms, although the latter rather than the former would seem the more likely.

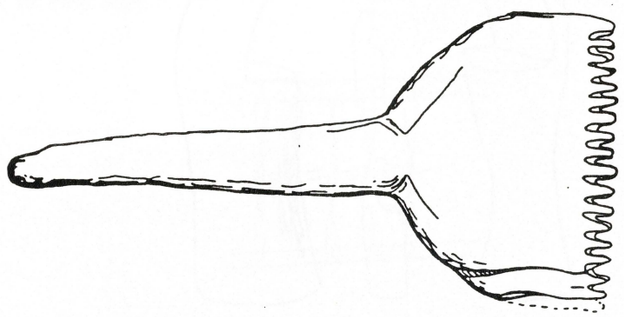


Fig. 48 Weaving comb (after Roth 1951, fig. 22)

Blocks: most of the depictions of vertical looms show the upright beams resting on blocks of some kind. Suitable blocks in stone have been found both inside and outside of houses at the Workmen's Village, Amarna (fig. 49; Peet and Woolley 1923:60-61). They are square in shape,

with a large groove carved out of them. They are made out of a limestone material and are extremely heavy. The stones were usually found in pairs (Vogelsang-Eastwood, in press).

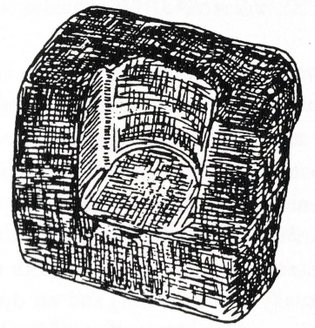


Fig. 49 Stone block from the Workmen's Village, Amarna

Warp-weighted looms

Finally, some words should be said about a suggestion put forward by various modern authors, namely that warp-weighted looms were used in Egypt during the Pharaonic period. The ancient nature of this form of vertical loom has been attested to by the discovery of loom weights in sequence in regions as far apart as Norway and Syria. In this loom the bottom beam is replaced by a series of stone, mud or clay weights which tension the warp ends. The warp-weighted loom is usually placed against a wall in order to produce a natural shed and the weft was inserted at the top of the loom and beaten in with an upward movement, as opposed to the downward movement associated with the fixed-beam loom described above.

It has been suggested that this type of loom was in use in Egypt. The concept was based on the discovery of a small number of weights similar in size and shape to loom weights found in Palestine and Greece (see for example, Roth 1951:21). Nevertheless such finds are isolated examples and no line of weights commonly associated with this type of loom have so far been found in Pharaonic Egypt.

A.C. Mace suggested that a single-weight loom may have been used, similar to the looms used in the village of Maharraq, close to the southern Lisht pyramid during the 1920's (Mace 1922:75-76). This type of loom, however, appears to be a much later development and is of Medieval date in Egypt. It is also clear from nineteenth and early twentieth century illustrations of single weight looms in use in Egypt that the weights were of a considerable size and weight and that they were made of stone rather than mud. None of the small, mud 'loom' weights found at Kahun and Amarna would appear to be either large or heavy enough to be used on a single weight loom.

DYEING AND DYES

The use of colours to decorate the human body has a long tradition throughout the world and it is likely that various substances were used to colour cloth from ancient times onwards.

The term *dye* is used in this section to describe any substance used for the colour of fabrics. *Dyestuffs* are the active components in the dye which form the colour. Although there are a number of substances, both organic and inorganic, which can be used to colour cloth, they are usually divided into two types. Firstly, *substantive* dyes which include substances that can be directly applied (for example, smeared on) to the fibres or cloth without any intermediary or *mordant* (literally "biting agent"; usually a metallic salt) and vat dyes. In the latter example, the fibres or cloth are usually dipped into a heated tub or vat of liquid containing the dyestuff in solution. The second type of dye is classed as *adjective* and includes dyes whereby the dyestuff cannot get a purchase on the fibres or cloth unless the material has been pre-treated with a mordant.

Dyeing in Pharaonic Egypt

Although the Egyptians are known for their love of colour and the paintings on the walls and floors of the houses, temples and tombs, it seems strange at first sight that so many of the surviving textiles were undyed. This may be partly due to the fact that coloured textiles were more carefully looked after and were not normally placed within a tomb. It could also reflect, however, the fact that flax is difficult to dye because it is made from cellulose. Wool, on the other hand, is made of keratin, an animal protein whose natural acids have an affinity with dyestuffs. As a result of the cellulose nature of flax, fewer linen textiles seem to have been dyed. This does not mean, however, that Egyptian cloth or clothing was left undecorated. A study of the textiles and clothing from the New Kingdom tombs of Tut'ankhamun and Kha, for example, has shown that sequins, beads, embroidery, applique, as well as coloured yarns were used to decorate clothing.

The use of dyed threads or cloth can be traced back to the 1st Dynasty, although with some hesitation, via a brownish linen found at Tarkhan and with greater confidence to the late 3th or early 4th Dynasty based on a red dyed fragment from Meydum.[6] The former should be treated with some caution as it is not certain whether the colour is natural; due to the cloth being actually dyed, or indicates some form of later staining. It was not until the New Kingdom that cloth was often woven which included coloured thread in some form.

The main possibilities of using colour can be divided into two groups. Firstly, the cloth was coloured in its entirety. Numerous fragments of coloured cloth have been found, but so far only one coloured garment seems to have been published. The garment in question is a bag-tunic found in the tomb of Tut'ankhamun which was dyed a yellow colour and decorated with stripes of green and brown with bands of ducks in green (Carter 50a; Egyptian Museum Cairo ME 1668).

[6] Midgley 1915:50; Midgley 1911:38, no. Fa. For a brief survey of dyes and dyeing in Pharaonic Egypt, see Lucas and Harris 1964:50-154; Barber 1991:223-239.

Secondly, coloured threads were used as stripes or bands either in the main body of the cloth (for example Amarna <2224>) or they were used in the selvedge stripes and transverse end bands (Vogelsang-Eastwood in press). Normally, only one colour was used for bands appearing in the cloth, while combinations of blue, red or natural were used in selvedge stripes and transverse bands.

Finally, so far no actual dye workshops, or their representations, have been found in Egypt. Nor does the act of dyeing seem to feature in the repertoire of the tomb painters.[7]

Pharaonic Egyptian techniques of dyeing

It is known from textile finds that four different methods of colouring cloth were used in Pharaonic Egypt, namely:

Smearing: whereby the colour was literally spread onto the cloth. Such textiles have been found at the Workmen's Village at Amarna (Germer, in press).

Substantive or vat dyes: one of the most common dyestuffs is *indigotin*, a dyestuff which must first be reduced in oxygen.[8] The solution is called the vat and is colourless. The fibres are dipped into the vat and then hung up in the air, The oxygen in the air oxidises the dyestuff and the fibres turn blue, while the dyestuff is fixed to the fibre. Most blues found in Pharaonic Egyptian contexts will have been produced in this manner.

Adjective; acid or non-vat dyes: an adjective dye is one where a mordant or metallic salt is added to the dyebath in order to fix the dyestuff to the fibre, thread or cloth. The fibres, threads or cloth could be first treated with a mordant or be added to the dyebath. By fixing the dye to the fibres the colour is made fast and more light resistant. A variety of mordants can be used in order to produce different effects. Mordanting with alum (a form of aluminium sulphate) for example, will normally create a bright colour, while iron (ferrous sulphate) will dull its appearance. Nowadays mordants are used with many dye plants, including most of those producing a red or yellow colour. When exactly the Egyptians started to use mordants is open to doubt as it is difficult to detect the presence of these substances, due to outside contaminants which occur naturally in Egyptian sand.

Double dyeing: besides dyeing blue and red individually, the Egyptians also carried out double dyeing. This is a process whereby fibres, threads or cloth are dyed one colour and then again with a different dyestuff in order to obtain another colour, for example, a purple (red and blue) or green (yellow and blue). It is not clear whether the first dyebath was a substantive form and

[7] Brunello quotes a description of a dyer taken from the Middle Kingdom text *Satire on Trades* (Brunello 1973:41). In the text the dyer is briefly described as follows: "The finger of a dyer has the smell of rotten fish. His eyes are red from fatigue". However, in the version published by M. Lichtheim the profession of stoker is suggestion, while the man smells of corpses and his eyes are red from the irritation of smoke (Lichtheim 1973:188).

[8] For a description of how indigotin is obtained see Mook-Andreae 1985:13-22. For information on the early history of indigotin, see Barber 1991:233-235; Hofenk de Graaff 1985:23-30.

the second an adjective or the other way around. Either is feasible.

Rare examples of double dyeing have been found at various sites in Egypt, including the Workmen's Village at Amarna. For example, a purple thread <1115> was recorded which had been dyed with indigotin and alizarin (see below; Germer, in press).

Finally, it is worth noting that it is rare to find coloured cloth which has been dyed while at the fibre stage, Normally, the Egyptians either dyed spun threads (white patches can be seen if the thread is slightly unspun) or woven cloth (white areas can be seen beneath the place where, for example, an end passes over a pick and so protects the lower thread).

The Dyes

The sources of dyestuffs in Pharaonic Egypt can be divided into two different basic types. Firstly, the ochreous earths and secondly, the plant dyes.

Ochreous earths

Ochre is an earth consisting of an hydrated oxide of iron mixed with clay. This substance can vary in colour from light yellow to deep orange or brown. Most natural ochres are coloured yellow because of the hydrate oxide. In addition, yellow iron oxide can be transformed into red iron oxide by heating it. Red ochres are coloured from the anhydrous ferric oxide. Thus it is possible using this substance to create yellow, yellow-brown and red colours.

F. Brunello has suggested that the ochre may have been mixed with a solution of gum (possibly *Acacia arabica*), honey or milk (Brunello 1973:42). So far, however, there is no actual proof as to whether a special fixative for the iron was used or not.

The dyeing of linen with iron oxide has a long tradition in Egypt, which may date back to the Old Kingdom (see the Tarkhan textile referred to above). Linen that was coloured red using iron oxide has been found at various sites including the Workmen's Village at Amarna (Germer, in press).

Plant dyes

A wide range of plants produce a colour of some kind. The number of plants, however, which will create a durable colour capable of being reproduced is considerably more limited. It is these plants which can be regarded as viable dye sources.

Blues: research has shown that one of the most common sources of the blue colour of Egyptian textiles is indigotin.[9] This substance is to be found in plants of both the *Indigofera* (for example, indigo) and *Isatis* species (for instance, woad; *Isatis tinctorum*). So at present it is impossible to determine exactly the origin of the dyestuff. However, written sources would suggest that woad was the source of the colour (Germer 1985:47-49).

As noted above, the more frequently the fibres or cloth are dipped into a blue dyevat the deeper the colour becomes. It is clear from New Kingdom finds, from the tomb of Tut'ankhamun and the contemporary Workmen's Village at Amarna, that both dark and light blue yarns

[9] Pfister 1937: Eastwood 1984: Germer in press.

were available. The relative social position of these finds would suggest economic reasons behind the difference in colour.

It has been suggested by Forbes that the seed pods of sunt (*Acacia nilotica*) may produce a blue colour (Forbes 1964:111). According to Germer, however, this is not the case (Germer, pers. comm).

Reds: besides colouring with iron oxide a second technique of red dyeing includes the use of madder. The main colouring ingredients are the anthraquinones, most notably *alizarin*, which are plentiful in the root of some *Rubia* species, for example, *Rubia tinctorum*. According to Germer this dye plant was introduced into Egypt, possibly from the Levant, during the 18th Dynasty (Germer 1985:48)

Other possible sources of red dyes during the Pharaonic period in Egypt include:

safflower (*Carthamus tinctorius*)
henna (*Lawsonia alba* or *L. inermis*)
alkanet (*Anchusa tinctoria*)

In addition, it is possible that archil (Orseille; *Roccella tinctoria*), a lichen, and kermes (*kermoccoccu vermilio*), an insect, were used for dyeing cloth red, but this is not certain.

Yellows: yellow textiles have been found, but so far the actual dyestuffs have not been identified. The potential sources of yellow dyes in Pharaonic Egypt are:

safflower (*Carthamus tinctorius*)
pomegranate (*Punica granatum*)

As noted above, the two most common dyestuffs associated with Egyptian textiles are indigotin and alizarin. Both of these substances are obtained from plants, namely woad and madder, which are not native to Egypt. According to Germer they were both imported from Palestine sometime during the 18th Dynasty (Germer, in press). It is not known, however, whether they were imported in the form of dyestuff or whether the cultivation of these plants was brought to Egypt. Among the plant remains from Pharaonic tombs, which contain food plants, spices and the flower decoration of the mummies, no plants have been found which contain indigotin or the roots of the madder plant.

Possible archaeological evidence for dyes and dyeing in Pharaonic Egypt

As noted previously at the beginning of this section it would appear that so far nothing has been found which can conclusively be described as evidence for dyeing in Pharaonic Egypt, apart of course from the textiles themselves. No dye works similar to those found by Petrie in Roman Athribis have been identified, nor as noted above have dye plants been found in tombs (Petrie 1908:11, pl. XXXV). Parallels, however, for the form of Pharaonic Egyptian works may be seen in the dye-works at Tell Bet Mirsim in Israel, which date to about 700 B.C. (Albright 1941-43, pl. 11b; Barber 1991:241-242). They contained, among other things, four large stone vats.

THE LAUNDRY AND STORAGE OF CLOTH

The wearing of white garments appears to have been regarded as an indication of social stature and, perhaps, as a sign of cleanliness. The value accorded to white and bleached cloth is indicated in an 18th Dynasty linen list given in the tomb of Rekhmire, Thebes (TT 100): "Menkheper Re' blessings on him - for the manufacture of king's linen, bleached linen, fine linen, ... linen, close-woven linen" (Davies 1943:47).

In the Middle Kingdom text *The Satire on Trades*, the man who washed the laundry is described as someone to be pitied:

> The washerman washes on the shore
> with the crocodile as neighbor;
> ["Father, leave the flowing water,"]
> Says his son, his daughter,
> [It is not a job that satisfies]
> .....
> His food is mixed with dirt,
> No limb of his is clean,
> [He is given] women's clothes,
> .....
> He weeps as he spends the day at his washboard
> .....
> One says to him "Soiled linen for you,"
> (Lichtheim 1973:189)

The laundryman described above was a professional worker, probably attached to a large estate of some kind, as are the men depicted in the Middle Kingdom tombs of Amenemhat (BH 2), Khnumhotpe (BH 3), Baqt (BH 15) and Khety (BH 17) at Beni Hasan and the New Kingdom tomb of Ipuy at Deir el-Medineh (figs. 50-52).[10] It is likely, however, that the women from smaller establishments washed their own household's linen.

As noted above, the washing of cloth is depicted in several tombs from Middle and New Kingdom tombs from Beni Hasan and Deir el-Medineh. The basic process appears to be the same. The first task is to dampen the cloth and then rub it, possibly with a detergent of some kind. Various natural detergents were available in Pharaonic Egypt, for example, natron (a natural soda); potash and the plant soapwort (*Saponaria officinalis*). The wet cloth was then beaten or rubbed with sticks or wooden clubs on a stone or a wooden base of some kind. Subsequently it was washed in water, rinsed and wrangled. The last task is depicted at Beni Hasan (Tombs 2 and 3) whereby one end of the cloth is wrapped around a post while the other is firmly twisted (see figs. 50 and 51). The damp cloth was then left to dry in the sun. This part of the process also had the effect of bleaching the cloth. Once the cloth was dry it could be

[10] Newberry 1893, I, pls. XI and XXIX; Newberry 1894, II, pls. IV and XIII; Davies 1927, pl. XXVIII.

folded prior to being stored until needed.

The two Middle Kingdom tombs at Beni Hasan show slight differences in the laundry process from the later New Kingdom tomb. These differences may be due to a variety of reasons, for example, the availability of water, the type of water or simply regional variations in how cloth was washed. In the tomb of Khnumhotpe (BH 3) for example, a group of men are shown washing cloth while standing in water (see fig. 51; Newberry, 1894, pl. XII D). They are beating the cloth with sticks and then wringing out the water. In the 19th Dynasty tomb of Ipuy at Deir el-Medineh, however, the men are shown beating the cloth and washing it in large pots (see fig. 52; Davies 1927, pl. XXVIII). One of the pots appears to be set in a stand while the other is set on the ground. Above this group other men are depicted who appear to be either

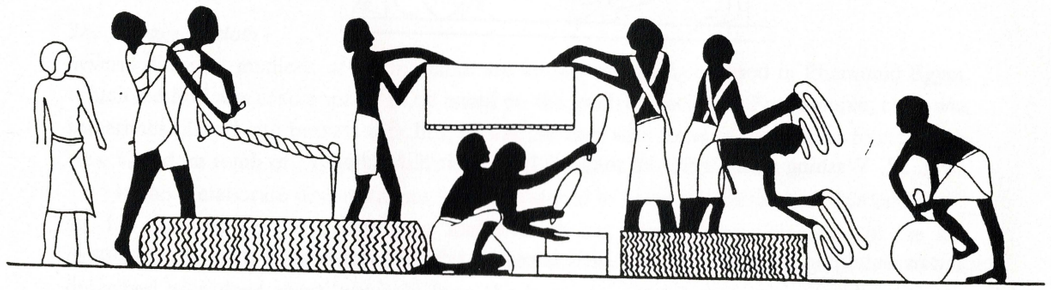


Fig. 50 Washing scene from the tomb of Amenemhat (BH 2).

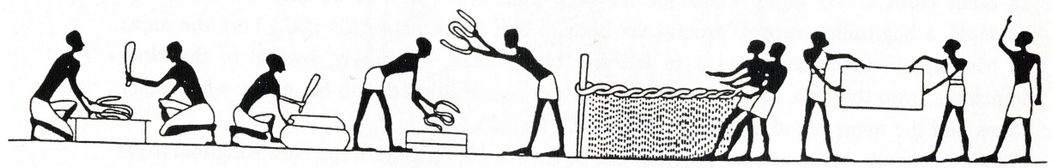


Fig. 51 Washing scence from the tomb of Khnumhotpe (BH 3).

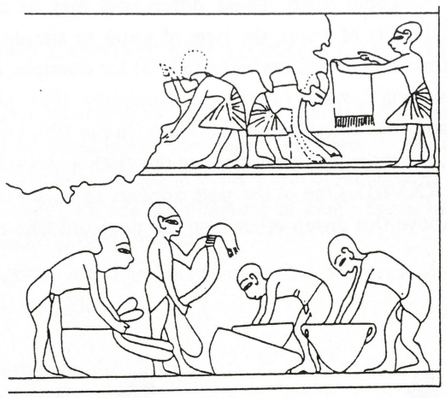


Fig. 52 Washing scene from the tomb of Ipuy, Deir el-Medineh.

folding or unfolding the cloth, although it is uncertain whether this is done prior to, or after the actual washing.

'Laundry' marks

Large quantities of Pharaonic cloth have been found which bear the name of the owner and some royal cloth even shows the regnal year in which the material was produced. It is likely that this was done not only to keep a check on the amount and quality of cloth within an establishment, but also to make it clear whose property it was when the cloth was sent to be laundered (fig. 53). Sometimes these names were painted with a form of black ink which did not wash out, as in the case of the marks on textiles found with the bodies of the so-called slain soldiers of Neb-Hepet-Re'Mentu-Hotpe (see for example, Winlock 1945, pls. XIV and XV). In other cases it was either embroidered, or a small mark was woven into the cloth. For example, a bag tunic wrapped around the body of Seti II (*ca* 1214-1204 B.C.) bore the name of Merneptah embroidered on it in red and blue thread.[11] Similarly, several of the cloth loincloths from the 18th Dynasty tomb of Kha were embroidered with his name, while other items had the name inked on (Schiaparelli 1927, fig. 62).

Another example of the marking of cloth can be seen in the finds from the New Kingdom tomb of Ra'-Mose and Hat-Nufer at Thebes (Langsing and Hayes 1937:24-26). A total of seventy-six lengths of cloth were recorded form the tomb, of which several included weaver's marks; twenty-nine had identification marks (either the state or temple stores) in ink, but only one had a private name (Boki) on it, again written with black ink.

[11] Smith 1912:75. Merneptah was a son of Ramesses II and later became pharaoh in his own right (*ca.* 1224-1214 B.C.).

Fig. 53 A selection of property and quality marks from Pharaonic Egyptian cloth (after Winlock 1945, pls. XIV and XV)

The Storage of cloth

Several different methods of storing cloth are known to have been used in Pharaonic Egypt. Which method was used appears to be based on the available facilities. For example, cloth was sometimes placed into baskets with lids, as was the case with some of the textiles found in the New Kingdom tomb of Merit, the wife of Kha (Schiaparelli 1927, fig. 80).

In more elaborate circumstances linen was stored in boxes. In the tomb of Tut'ankham-un, for example, several chests were found which included lists on the inside of the lids describing the cloth contents. For example, chest no. 101 (Egyptian Museum, Cairo, 61468) is described as a linen chest, not only from the large number of textiles it included, but also because of the inscription on the inside of the chest's lid which described its original contents.

Three chests containing linen were found in the New Kingdom tomb of Ra'-Mose and Hat-Nufer at Thebes (fig. 53; Langsing and Hayes 1937:24-26, fig. 37). Two of the chests were made from sycamore boards in the form of plain rectangular boxes with flat lids. The third box

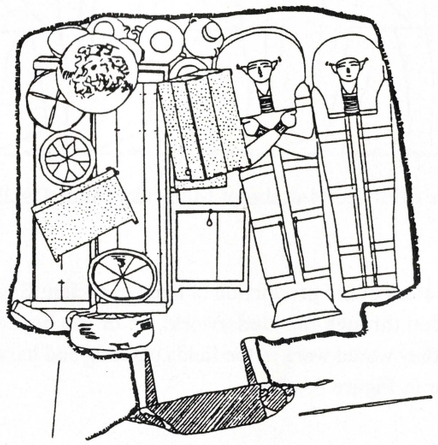


Fig. 53 Three chests containing linen from the tomb of Ra'-Mose and Hat-Nufer, Thebes (after Langsing and Hayes 1937, fig. 37)

was of pine and had a gabled lid and four small legs. All of the boxes were whitewashed on the inside and outside. The boxes contained a total of seventy-six lengths of cloth which varied in quality from coarse to very fine, and in colour from dark brown to white. Finally, gabled boxes for linen are also depicted in a number of tombs. In the Mastaba of Mereruka, for example, there are several scenes showing servants carrying lengths of cloth and chests containing cloth (fig. 54; Duell 1938, pl. 72).

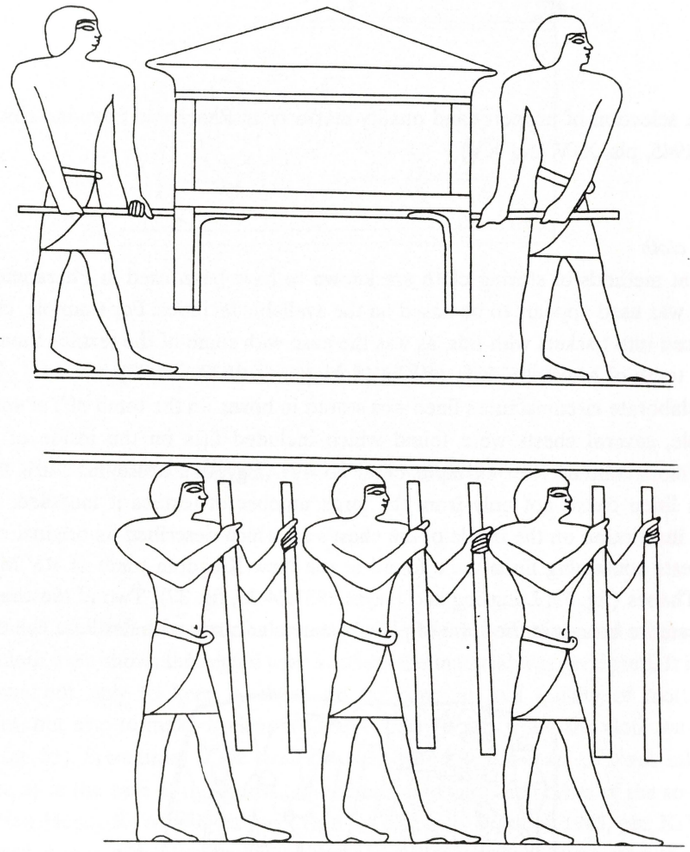


Fig. 54 Linen chests from the Mastaba of Mereruka (after Duell 1938, pl. 72)

Finally, to bring the story of the production of linen in ancient Egypt to a conclusion, when a person died and travelled through the Underworld, he or she hoped to eventually reach the Fields of Paradis. There they would work in the fields planting and harvesting wonderous crops, including, as can be seen in Figure 55, flax.

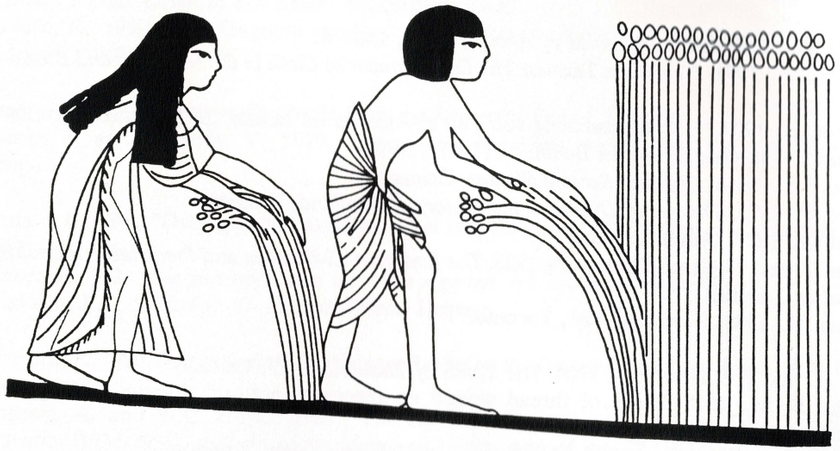


Fig. 55 Sennedjem and his wife Iyneferti working in a flax field (tomb of Sennedjem, Theban Tomb 1, 19th Dynasty)

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